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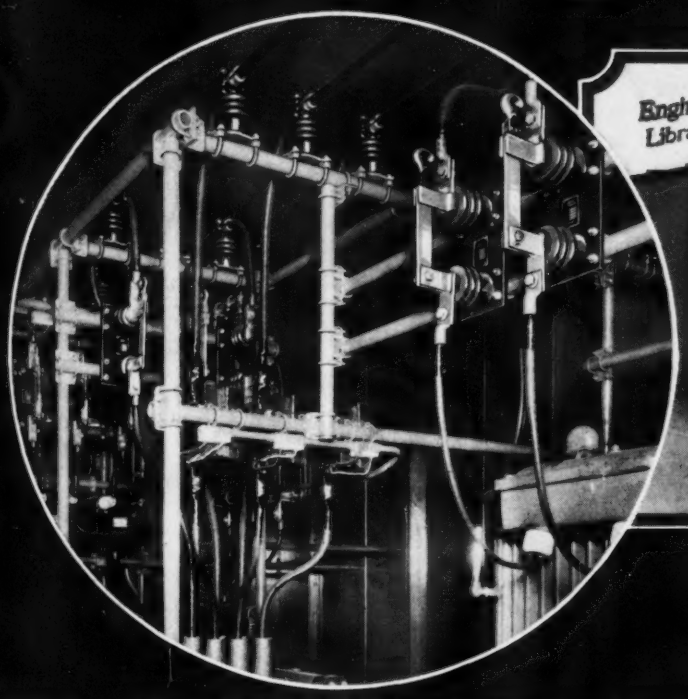

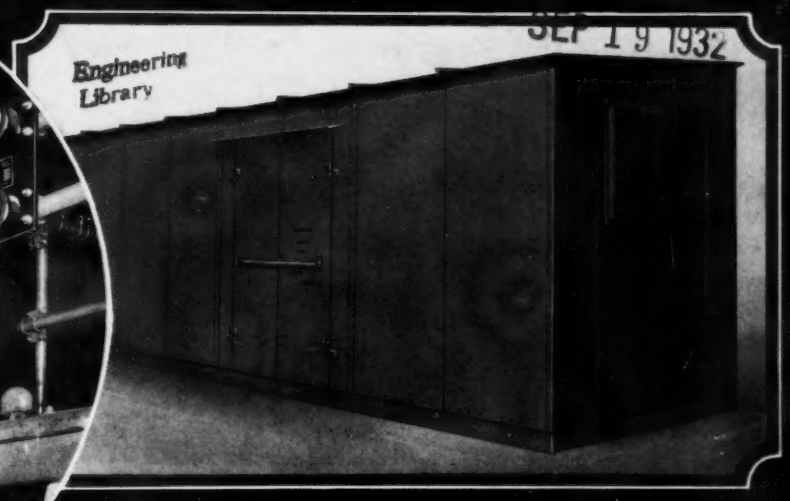

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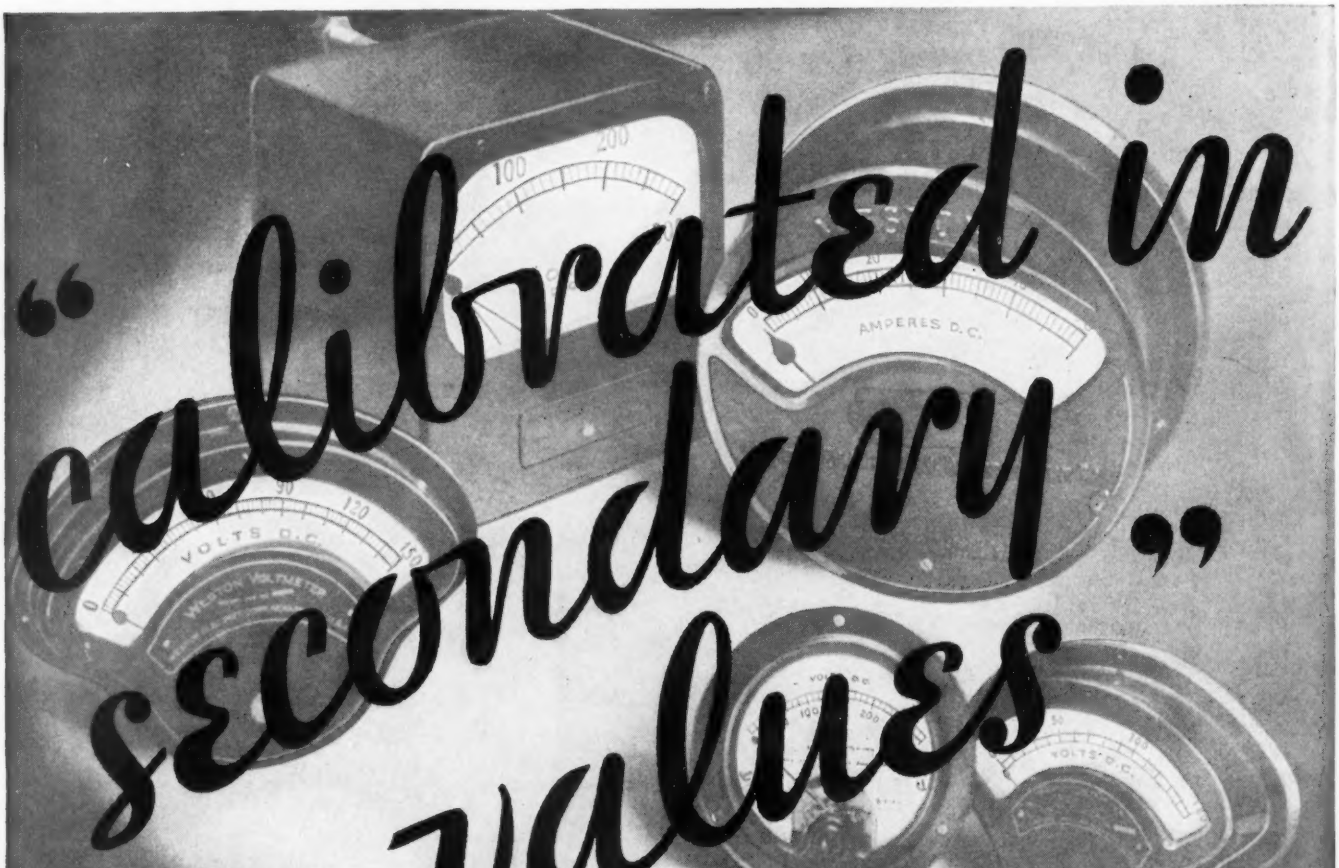

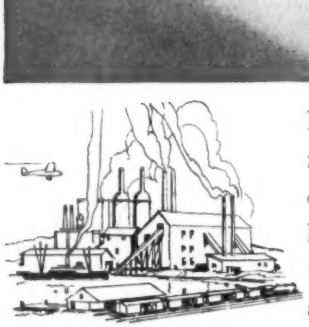

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ELECTRICAL WORLD

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for the Week Ending

September 17, 1932

Edison Memorial Dinner Concludes 50th Anniversary Observance

SECOND of the celebrations to be held in commemoration of the 50th anniversary of the founding of the electric light and power industry took place on Monday of this week, when nearly 500 industrial leaders, scientists, engineers, bankers and utility men met at a memorial dinner at the Waldorf-Astoria in New York. Last week simultaneous observances and ceremonies were conducted in New York and Detroit.

Frank W. Smith, president of the New York Edison Company, presided. Addresses were made by George B. Cortelyou, president of the National Electric Light Association and the Consolidated Gas Company; F. L. Carlisle, chairman of the boards of the New York Edison Company, Consolidated Gas Company and Niagara-Hudson Power Corporation, and Frederick H. Ecker, president of the Metropolitan Life Insurance Company. A metal model of Edison's Pearl Street station with working machinery was displayed and a bronze tablet in commemoration of fifty years of Edison service unveiled.

Personality of Edison dominated era

"Back of all institutions," said Mr. Cortelyou, "are personalities. We cannot understand the meaning of events without some knowledge of the personalities behind them.

"Of course the first person we encounter in the electric light and power industry is the towering figure of Edison, the founder. Nothing that has been said, or that can be said, can add to the measure of his stupendous achievements.

"The courage and faith which he urged upon others was but a projection of his own faith and courage which drove him forward in the face of unimaginable difficulties. To him there was no problem without a solution, and if the solution was hard to find this only intensified his determination to find it, and find it he invariably did. His patience, persistence and prodigious activity were legendary even in his own lifetime. He made in all about 225 inventions on the lamp, dynamos and his system of distribution before Pearl Street could be opened for operation on September 4, 1882. The best summation of the significance of the Pearl Street station was given by Edison himself. He said: 'The operation of Pearl Street meant the end of one epoch in civilized life and the beginning of another.'"

Could Edison do it today?

"A fifty-year anniversary of any kind in this rapidly changing, modern world is an event worth celebrating," Floyd Carlisle told the gathering. "The anniversary of the introduction of electricity into common use is infinitely more. But fifty years ago no one except Thomas A. Edison and a few of his intimate associates, and to their great credit a few bankers, even dimly saw the future consequences."

As for Edison's Pearl Street venture, Mr. Carlisle said: "This was frankly a great experiment, probably the most important one ever undertaken in practical economics. I rather doubt, if the present blue sky laws of the various states were in effect then, that the security issue would have been approved. Government ownership of the competing gas companies would probably have strangled it. It is doubtful, under regulation, whether a certificate of necessity and convenience could have been secured. That great practical introduction of electricity was due primarily to confidence in the great ability and high moral character and reputation of Thomas A. Edison. All credit to him, to his associates and to his bankers for their courage, foresight and success!

"Our attitude toward regulation is quite frank and open. Sane and reasonable regulation by the state is preferable to making rates with municipalities by contract, which is really what preceded our present system. Our greatest danger, I believe, is over-regulation. Thomas A. Edison voiced it when he said five years ago: "Great days are ahead of this nation and the world, and electricity will have a great part to play, granted

This Week

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only that it can be unfettered, with full opportunity for the largest possible individual initiative and energy.

"There are many honest and well-meaning people who say that government regulation of this industry has failed in practice. Their remedies are many, all involving some form of government ownership. In my judgment, if the government cannot successfully regulate this industry, it cannot successfully own and operate it."

"The public utility companies in particular, which include electric power and light, gas, water and communication companies, possess characteristics which make the senior securities of companies operating in these fields, as a class, very satisfactory investments for life insurance and for all fiduciary institutions," pointed out F. H. Ecker.

"While public utility securities are considered among the safest investments today, the long future is always uncertain, and it seems that the utility managers should endeavor to profit from the present plight of the railroads and take measures while their credit is high to bring about a lower ratio of borrowed capital to total investments, to the end that they may not become financially embarrassed under any circumstances in the future, Mr. Ecker declared."

Carolina Utility Drops State Tax Fight

Agreeing to abandon its appeal to the United States Supreme Court, in which action was to have been taken to prove the electric power excise tax unconstitutional, the South Carolina Power Company of Charleston, S. C., has paid to the state Tax Commission $49,848.78, covering amount due over a period of fifteen months, or since May, 1931. The tax in question is a levy of five-tenths of a mill on every kilowatt of electric power generated or sold in the state. It was imposed by a special act which was passed by the South Carolina Legislature in 1931.

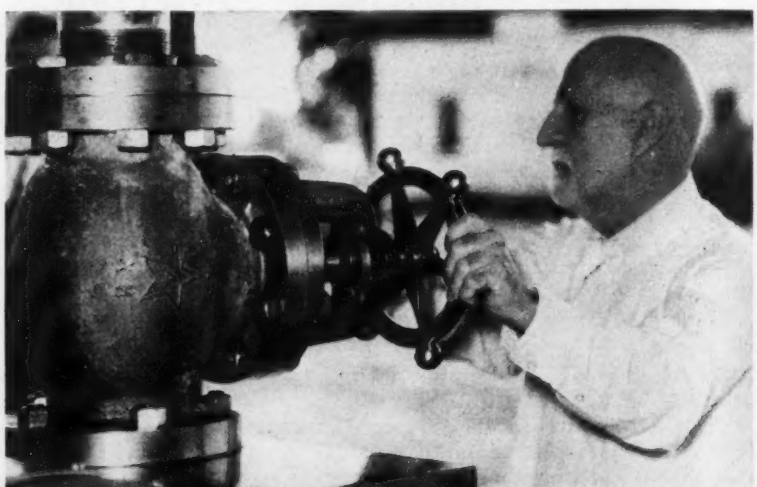
The action of the power company brings to a close, so far as this company is concerned, a long court litigation started shortly after the tax was imposed. This company, along with the Lexington Water Power Company and the Broad River Power Company, sought an injunction before a three-judge federal court to prevent the Tax Commission from collecting the electric power tax. Following an adverse decision the South Carolina Power Company appealed to the United States Supreme Court. The other companies are perfecting their appeals to this highest law tribunal.

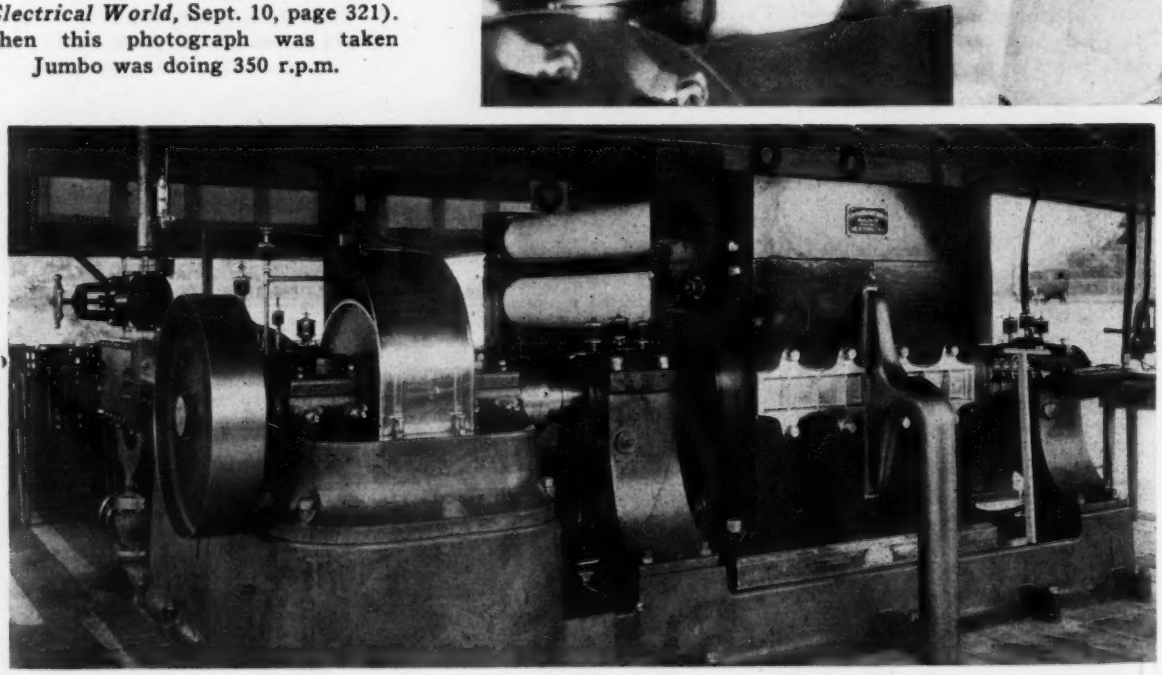
In the cases of the Duke Power Company and the Southern Public Utilities Company, both of which have paid the tax under protest and are bringing suits to recover the revenue, the general counsel for the corporations states that the two companies wish to present some points in the Supreme Court that were not brought out in other cases. The companies have filed seven suits each in the United States District Court seeking to have the taxes refunded.

Two other companies have also paid the tax under protest and are bringing suits in the Richland County Court of Common Pleas to have the money returned to them. These are the Lockhart Power Company and the Union Manufacturing & Power Company.

WHEN EDISON'S JUMBO NO. 9 ROLLED AGAIN

Brightly polished, rebuilt and thoroughly tuned for operation, Edison's Jumbo No. 9, now at Henry Ford's Edison Institute, Dearborn, Mich., once more ran and hummed smoothly when Alex Dow, president of the Detroit Edison Company, opened the steam valve on Sunday, September 4 (*Electrical World*, Sept. 10, page 321). When this photograph was taken Jumbo was doing 350 r.p.m.





Pinchot Controls Board if Appointments Stand

Governor Pinchot of Pennsylvania, after a long fight, has achieved control of the Public Service Commission by appointing to the board his private secretary, P. S. Stahlnecker, and his Secretary of Revenue, Dr. Clyde L. King.

This gives him four of the seven votes of the commission and he will have an opportunity to make another appointment on October 1, when the resignation of Commissioner Emerson Collins becomes effective.

Both appointments are subject to confirmation by the Senate.

"It will be said," the Governor stated, "that I have selected men who hold the same views on public utilities that I do. Of course I have. Believing that these views are sound and that they will secure even justice for public and utilities alike, I could do nothing else."

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Federal Power Report to Be Issued Shortly

The report of the Federal Power Commission on holding company control of licensees under the federal water-power act (ELECTRICAL WORLD, August 27, page 260, and August 20, page 229), preliminary releases of which have already appeared, will be made public September 18.

From the facts gathered, the commission concludes that "public control of holding companies in the power utility field is absolutely essential in the public interest." The preliminary statement of the commission further pointed out that much of the information necessary for carrying out the purposes of the federal water-power act "is altogether within the control of holding companies."

The report will be illustrated with more than a score of charts of the corporate structure of the groups formed by the "top" companies and their subsidiaries.

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California Edison Would Yield Hoover Dam Rights

Contending that it can generate power at its Long Beach steam plant cheaper than it can be purchased from the Boulder Dam hydro plant now under construction with government funds, the Southern California Edison Company has offered to the Los Angeles City Council to relinquish its claim to purchase 9 per cent of the total power to be generated at Boulder Dam, plus an additional amount up to 18 per cent in the event that the states of Arizona and Nevada do not take the shares allotted to them in the agreement.

The Edison company made the offer in answer to charges that it was attempting to monopolize the purchase of power from the dam. Two members of the Bureau of Water and Power Commission have recommended that the Council accept the offer, which has a time limit of 30 days.

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Complete Electrification Plan of N.E.L.A. Committee

Based upon the three objectives of selling—a complete equipment of built-in major appliances, complete equipment of artistic lighting fixtures which give scientifically correct illumination and adequate and complete wiring—the new residence sales committee of the National Sales Section of N.E.L.A. has prepared a plan which calls for carefully directed personal selling and cooperation with local building interests.

The committee, according to P. M. Downing, chairman of the National Sales Section, is of the opinion that the plan is so comprehensive in scope, practical in suggestion and simple in ways and means of developing a continuous activity in every community that all commercial executives will immediately inaugurate a program in the territories served by their respective companies.

A presentation book, "That She May Have More Leisure," the plan book and the recently formulated "Adequacy Wiring Standards for Residence Buildings" constitute the three elements for action. The presentation book dramatizes the need and value of good lighting and adequate wiring.

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Englewood, Colo., Votes for Municipal Plant

Englewood, Colo., on September 2, at a special election, committed itself to municipal ownership of its water and power plants when taxpayers voted, 774 to 578, in favor of a $750,000 bond issue to finance the projects.

A contract had already been entered into by the Englewood City Council—subject to ratification by taxpayers—with the Municipal Power Development Company, for construction of the power-water plants.

Colorado Central Power Company has secured a temporary injunction restraining all parties from going ahead with the work. Each side has until October 3 to present its side.

Englewood for years has purchased water from the Denver Water Board and its electricity from the Colorado Central Power Company. Mayor J. E. Abbott of Englewood led the fight for municipal ownership. Dissatisfaction with the present water service and a belief that the community will profit handsomely by operation of its own electric system caused the change (ELECTRICAL WORLD, August 27, page 264).

September Test Starts With Waverings

PARADOXICALLY enough, just when the indexes of business activity show the first embryonic stirrings of vitalization security markets, commodity prices and enthusiasm show signs of waning. Just as, for the past few months, speculation and high hopes ran directly opposite to business and trade facts.

Car loadings and energy production continue the slight but appreciable improvements evidenced in last week's figures. Textile conditions show sustained strength. Bituminous coal production rises. Steel wavers around 15½ per cent of capacity, but unfilled orders rise somewhat.

General business indexes show small gains, but the past week has been disappointing in general. Stocks suffered the worst reaction so far in the current security market upswing and worldly-wise Wall Street appears to concede that possible trade gains have been generously discounted. Maine election results upset some speculative thinking and brought out the bears.

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Power Board Reopens Lockport-Niagara Case

That the city of Lockport, N. Y., which seeks the diversion of 275 cu.ft. per second of the flow of the Niagara River for a municipal hydro-electric development, and the Niagara Falls Power Company, using that volume of water under a temporary permit expiring on August 31, might have opportunity to present their respective sides of the question the Federal Power Commission has set a hearing for November 3. In the meantime authorization for continued diversion has been given Niagara Falls Power.

In January the commission ruled that no water was then available for disposition and the city's application was denied without prejudice. This continued use of the Niagara River to the full extent permissible under the treaty of 1910 is regarded as absolutely essential and in its order the commission states "it is of the utmost public importance and the highest public interest that the beneficial use of this water shall not be interrupted."

Comment by Chairman Smith of the commission indicates that the issue of largest public moment is not so much by whom the water shall be used as that it shall be used most effectively.

Coming Meetings

Electrochemical Society — Cleveland, Ohio, Sept. 22-23. Colin G. Fink, Columbia University, New York.

National Electrical Manufacturers Association — Westchester Country Club, Rye, N. Y. Sept. 26-29. A. W. Berresford, 570 Lexington Ave., New York.

Illuminating Engineering Society—New Ocean House, Swampscott, Mass., Sept. 26-30. E. H. Hobbie, 29 W. 39th St., New York.

National Electrical Wholesalers Association—Hotel Statler, Buffalo, N. Y., Sept. 26-30. E. Donald Tolles, 165 Broadway, New York.

American Welding Society — Buffalo, N. Y., Oct. 3-7. M. M. Kelly, 29 West 39th St., New York.

National Electric Light Association—Engineering Committees meeting, Edgewater Beach Hotel, Chicago, Ill., Oct. 3-7. A. J. Marshall, 420 Lexington Ave., New York.

National Safety Council—Washington, D. C., Oct. 3-7. W. H. Cameron, 20 N. Wacker Drive, Chicago.

Great Lakes Division, N.E.L.A.—Executive conference, French Lick Springs, Ind., Oct. 6-7. T. C. Polk, 20 N. Wacker Drive, Chicago.

Association of Electragists International—Kansas City Mo., Oct. 10-12. L. W. Davis, 420 Lexington Ave., New York.

American Institute of Electrical Engineers—Middle Eastern District Meeting, Baltimore, Md., Oct. 10-13. H. H. Henline, 33 West 39th St., New York.

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Broadened Outlook Vital, Great Lakes Group Is Told

Intense absorption of the engineer in his professional problems has a tendency to close his mind, or at least dull his perceptions, to destructive economic forces which may, if not arrested and controlled, not only set at naught his physical achievements but may, in fact, destroy the very basis of liberty, S. B. Way, president of the Milwaukee Electric Railway & Light Company, told the Great Lakes Division, N.E.L.A., last week. The vigor and earnestness of Mr. Way's talk on the mounting menace of taxation made it the high point of the Milwaukee meeting.

That interconnection with a utility is an economic necessity for any industrial that cannot achieve a balance between its electricity and process steam demand was the conclusion to be drawn from the discussion of power in industrial plants using process steam by Grover Keeth of the Marathon Paper Company. How the heat treating of metals by means of controlled gaseous atmospheres in electric furnaces is being improved in technique, speed and cost was explained to the club by H. E. Koch of the Hevi Duty Electric Furnace Company. Discussions on experiences with oil engines, led by J. S. McMillen, Northern States Power Company, and air conditioning, led by E. W. Atkison, Public Service Company of Northern Illinois, showed the difficulties and opportunities in both fields.

At the engineering committee meetings, although poor attendance was expected, the committee rooms were filled to capacity. Problems in achieving further economies dominated the committee meeting discussions. The assertion by Leo Shapiro that $1,000,000 had been saved on the system of the Central Illinois Public Service Company by reduction of system losses in ten years brought out much discussion in the overhead systems committee on the method of calculating that million dollars, whether it should be on switchboard costs or merely on increment costs of generation. Control of system short-circuit current was the topic that most engaged the attention of the joint meeting of the electrical apparatus and power systems engineering committees. The prime movers committee deliberated on the problems of station piping, while the meter men devoted their time to test methods for, and accuracy of, polyphase meters. Foreign systems coordination and accident prevention also had their interested adherents.

Much of value and interest was contributed to these N.E.L.A. meetings by the fact that they were coincident with the Great Lakes Power Conference, which included the annual convention of the National Association of Power Engineers and an extensive exhibit of power plant equipment.

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Outside Speakers Predominate in Pennsylvania Meeting

THE silver anniversary convention of the Pennsylvania Electric Association was held in Bedford Springs, September 7, 8 and 9. More than 500 attended the meeting and enjoyed an unusually good business program. Notable addresses were delivered by David Lawrence, editor the *United States Daily;* Congressman C. A. Eaton; H. C. Young, vice-president Bell Telephone Company; Walter Linn, secretary Pennsylvania Self-Insurers' Association; George B. Cortelyou, president N.E.L.A. and Consolidated Gas Company; Leonard Dreyfuss, president United Advertising Corporation; Ely C. Hutchinson, editor *Power;* L. W. Wallace, executive secretary American Engineering Council; Dr. L. D. Edie, president Capital Research Company, and others. Economics and public relations dominated the program.

Congressman Eaton gave an intimate story of political life in Washington and showed that the aid of the utilities both in conducting their business well and in voting intelligently was necessary to protect the American ideas of government and business against new conceptions in this period. Dr. L. D. Edie gave a splendid economic analysis and stated that in his opinion the trend toward industrial decentralization and new types of transportation would be very strong. He pointed out that the utilities were in the limelight politically and that socialistic ideas would be tried out on them first unless care were exercised. In his opinion, unless the up-and-down waves of price levels are eliminated it will be necessary for even the semi-rigid rate structures of the utilities to follow the trends.

In the opinion of Dr. Edie, utility executives should take the lead in the new economic trends. They should survey their areas and help relocate industry so that costs may be reduced. Economic pressure to reduce costs is the next big movement in industry and utility responsibility and opportunity in this trend is very great. These trends can be controlled if plans are made in the light of economic facts.

The machine age and technological unemployment was the theme of L. W. Wallace. He challenged assertions that technical advances had created unemployment and pointed out the unbalanced social and economic forces that created depressions and booms.

Competition in power production was discussed by Ely C. Hutchinson. In his opinion private plants would continue and this competition is now very keen for several reasons. Unemployed engineers are after business, the cessation of utility buying has caused manufacturers to focus on this market, the general drop in prices makes older investments by utilities out of line and technical advances in small power plants have been very great. He stated that the economic approach to power production should be used and that an unbiased study should be made of each case.

Public relations are gained by good service and by the daily contacts of informed and courteous employees, in the opinion of H. C. Young. This thought was stressed in other addresses, including that of President George B. Cortelyou of the N.E.L.A., who gave an encouraging note by his statement of the accomplishments of the industry and the goals toward which it was striving. David Lawrence discussed current economic problems and outlined the basic national conditions. The work of industry women was the topic at one session, with a splendid address on home service by Florence Freer, Brooklyn Edison Company, and another by Frank R. Phillips, president Philadelphia Company, on the attitude of employees.

Leonard Dreyfuss gave a stirring ad-

dress in which he said utilities must get tomorrow's business by sales. President W. H. Wade gave an encouraging report of the year's work and other utility speakers spoke of conditions with confidence that the future was promising.

Officers elected for the coming year are: President, Philip H. Powers, West Penn Power Company, and vice-president, E. W. Judy, Duquesne Light Company. A. B. Millar and Harold A. Buch were re-elected manager and secretary-treasurer respectively. H. B. Bryans continues as a vice-president.

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Detroit Edison Hearing Ends; Dividend Cut

Though the hearing on the petition of the city of Detroit for a reduction in Detroit Edison Company rates has been concluded no decision by the Public Utilities Commission will be made until after briefs are filed by the city, the company and the Michigan Manufacturers' Association.

Two questions are to be answered by the utilities body. The most important is whether the city's charge that rates are excessive warrants an audit and appraisal of the Detroit Edison property to be used as a basis for rate revision. An audit and appraisal will take about a year. The other question is whether a temporary reduction should be ordered pending completion of the appraisal, if one is made.

Cross-examination of Alex Dow, president of the company, was conducted at a closing session by James E. Lee, assistant corporation counsel of Detroit, and Frank E. Robson, attorney for the Michigan Manufacturers' Association. Mr. Dow asserted the company has no compilation of operating costs, fixed charges and investment upon which rates are made. He declared the only basis for the rate schedule is to fix earnings so as to bring a reasonable return on a fair investment. The rates are regulated principally by "horse-sense," he told the commission.

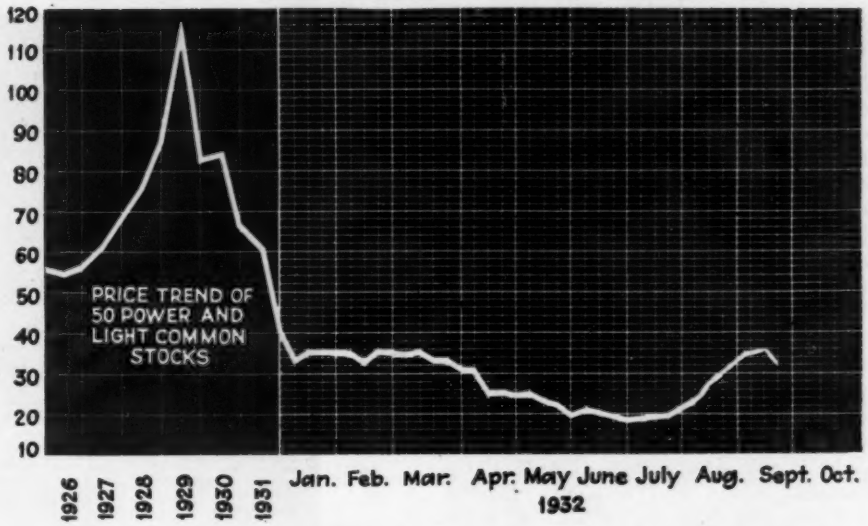
Dividend reduced

The board of directors of the Detroit Edison Company has reduced the dividend from $8 a year to $6 a year. In announcing the dividend, President Alex Dow made the following statement:

At the time the board declared the July 15 dividend it was announced that unless there should be a substantial improvement in the company's business by the time action was required on the October 15 dividend reduction to a quarterly rate of not more than $1.50 per share might be then deemed advisable. At the meeting of the board held on September 9 a dividend was declared at the quarterly rate of $1.50 per share.

The earnings statement of the company for the twelve months ended August 31, 1932, the latest available figures, showed that net income had declined to $8,109,184 from $8,549,806 for the twelve months ended July 31 and from $8,936,383 for the twelve months ended June 30. For the twelve months ended August 31, 1931, net income amounted to $11,271,244.

Utility Stocks Recede



Following the trend of the general market, utility stocks receded from the high levels established early in the month, a break occurring along the entire list. The "Electrical World" index dropped to 32.2, as compared with 36.0 for the preceding week.

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Current Earnings Reports of Electric Light and Power Companies

Operating Companies

	1932	1931	Per Cent Increase	Operating Ratio 1932	Operating Ratio 1931
Detroit Edison (Year ended August 31)					
Gross earnings	$45,624,965	$50,685,285	— 9.9	69	66
Net earnings	14,132,759	17,198,912	—17.9	..	..
Net profit	8,109,184	11,271,244	—28.1	..	..
Eastern Texas Electric (Year ended July 31)					
Gross earnings	8,298,607	9,777,149	—15.1	68	69
Net earnings	2,651,728	3,007,045	—11.8	..	..
Net profit	189,058	610,774	—69.0	..	..
Gulf States Utilities (Year ended July 31)					
Gross earnings	5,653,759	6,746,778	—16.2	64	66
Net earnings	2,046,796	2,313,123	—11.5	..	..
Net profit	392,061	702,853	—44.1	..	..
Puget Sound Power & Light (Year ended July 31)					
Gross earnings	14,470,503	16,425,388	—11.9	55	63
Net earnings	5,666,398	6,003,552	— 5.6	..	..
Net profit	741,800	549,232	35.1	..	..
Southern California Edison †† (Year ended July 31)					
Gross earnings	38,888,168	41,247,713	— 6.0	31	32
Net earnings	26,702,507	28,112,208	— 5.0	..	..
Net profit +	19,758,345	21,115,058	— 6.0	..	..
Virginia Electric & Power (Year ended July 31)					
Gross earnings	16,149,350	17,091,791	— 5.5	65	67
Net earnings	5,577,961	5,695,939	— 2.1	..	..
Net profit	2,536,578	2,790,448	— 9.1	..	..

Holding Companies

	1932	1931	Per Cent Increase	Operating Ratio 1932	Operating Ratio 1931
American Power & Light (Year ended July 31)					
Gross earnings	$78,203,865	$85,107,735	— 8.1	53	54
Net earnings	36,983,821	39,140,926	— 5.5	..	..
Net profit	14,437,862	18,363,793	—21.4	..	..
American Water Works & Elec. (Year ended July 31)					
Gross earnings	46,346,182	52,003,762	—10.9	56	58
Net earnings	20,510,301	21,717,578	— 5.5	..	..
Net profit	3,952,064	4,776,330	—17.2	..	..
Commonwealth & Southern and subs. (Year ended July 31)					
Gross earnings	121,279,438	134,713,586	— 9.0	53	55
Net earnings	57,004,048	61,112,035	— 6.7	..	..
Net profit	8,949,782	16,435,176	—45.5	..	..
Public Service of N. J. and subs. (Year ended July 31)					
Gross earnings	131,246,240	139,017,481	— 5.6	66	67
Net earnings	44,586,272	45,136,851	— 1.2	..	..
Net profit +	30,235,057	31,491,611	— 4.0	..	..

Gross earnings — Gross operating revenue. Net earnings — Earnings after deduction from gross earnings of operating expenses taken to include taxes, depreciation, maintenance, operating, etc. Net profit — Balance available from income for common stock dividends.

Insull Audit Shows $226,000,000 Deficit

That Insull Utility Investments, Inc., had assets of but $27,473,364 to meet liabilities (including outstanding stock) of $253,984,340 was one of the startling elements shown in the auditor's report filed this week and indicating conditions as of the date of receivership. Eliminating the capital stock item, the actual liabilities were $105,947,768, leaving a deficit of $78,474,404 that apparently wiped out the $58,645,028 of debenture bonds and still left a deficiency of nearly $20,000,000, or about half of what bankers had loaned the company.

Bank loans totaled $41,585,020 and other loans $2,009,645, giving a total, including accrued interest, of $43,705,384. Cash assets were $9,721. Securities owned had a book value of $237,892,050 and a market value of $30,402,267 when the crash came. Subsequent rise in security market prices has improved the outlook for creditors appreciably. But the bank loans hold precedence over debentures and unless the security market continues to rise prior to the liquidation of investment accounts the bankers will not get their money back, and even in the event of further market gains the debenture holders are likely to get very little. Stockholders appear to be completely wiped out.

The auditor's report criticised the methods of bookkeeping used by the company and called attention to the "inconsistencies of accounting methods." The report states that the balance sheet should have shown losses instead of profits and income during the years since 1929 if a consistent method had been followed in regard to accounting for stock dividends and other profit and loss items dealing with dividends, sales of stock rights and other transactions had been followed.

Coincident with the filing of the report a petition asking intervention in the receivership proceedings was entered, indicating that members and friends of the Insull organization divided $78,900,598 through profits on the underwriting syndicate distributing the stock of Insull Utility Investments, Inc. Existence of a favored list of 1,200 to 1,600 friends who were allowed to purchase various stock offerings of the company at prices considerably below the market is implied but not expressed in the petition.

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To Study U. S. Railways

Further extension of Austria's now-partially electrified Federal Railways may impend. Egon Seefehlner, general manager of the system, is visiting the United States to study roads and equipment where electricity has supplanted steam and will investigate both construction and operating factors.

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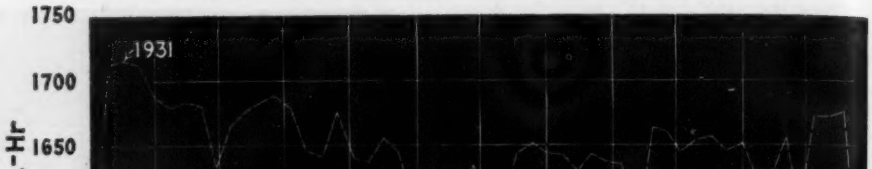
Strong Upward Trend in Energy Output



DIPPING much less than in the week containing Labor Day last year, electrical energy production by central stations during the week ended September 10 was down only 8.7 per cent compared with the corresponding week of 1931; that is, 1,443,977,000 kw.-hr. against 1,582,267,000 kw.-hr. Despite the holiday, production exceeded that of every week since the end of April with two exceptions only. The approach to 1931 is closer than at any time since the middle of March.

The disparity attained a maximum of 13.9 per cent in the week of July 16. Since that date the gap has been diminishing, at first gradually, lately more rapidly. As is evident from the regional percentages the improvement has been particularly marked in New England, although every section participated.

Weekly Output, Millions of Kw.-Hr.

Week Ended	1932	1931	1930	1929
September 10	1,444	1,582	1,727	1,806
September 3	1,465	1,636	1,630	1,675
August 27	1,436	1,638	1,688	1,762
August 20	1,432	1,643	1,691	1,750
August 13	1,415	1,629	1,677	1,733

Per Cent Change from 1931

Region	Week Ended Sept. 10	Sept. 3	Aug. 27
Atlantic Seaboard	— 3.8	— 5.8	— 8.2
New England alone	— 3.9	— 7.5	— 8.6
Central industrial	—13.1	—13.6	—15.2
Pacific Coast	— 7.5	—10.5	—11.9
United States	— 8.7	—10.4	—12.3

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Did July Energy Output Show a Gain or a Loss?

Public utility energy output, as reported monthly by the United States Geological Survey, generally permits of simple comparisons from which the state of industrial activity can be broadly inferred. Conclusions from the figures for last July are not quite so obvious.

Taking the month as a whole, the 6,525,000,000 kw.-hr. now reported shows a decrease from the 6,548,000,000 kw.-hr. of June and a most unusual drop compared with the 7,772,000,000 kw.-hr. for July of last year. This is a decrease of 16 per cent and at first glance indicates a recession from the conditions in June, when the percentage was 13 per cent. The average daily production was 210,500,000 kw.-hr., nearly 4 per cent less than the average in June, computed on the same basis. The normal change from June to July is a decrease of about 1½ per cent.

But the report points out that if the average is based on the number of working days in July and June, instead of total days, July makes a much better showing. As there were five Sundays and five Saturdays in July and the "Fourth" came on Monday, the working days were only 22½, while in June there were 24. The average production of electricity per actual working day was 272,800,000 kw.-hr. in June and 290,019,000 kw.-hr. in July, an increase of 6 per cent.

Moreover, June, 1931, and June, 1932, are strictly comparable in number of working days, whereas there were two less in July this year than last and the average production per working day was only 8.5 per cent less. On this basis the comparisons apparently indicate an improvement in the demand for electricity from June to July.

Aims of Rehabilitation Committee Outlined

Plans for an intensive equipment modernization movement throughout industry as one means of breaking the unemployment deadlock now keeping more than 11,000,000 workers out of jobs have been outlined by A. W. Robertson, chairman of the national Committee on Industrial Rehabilitation and chairman of the board of the Westinghouse Electric & Manufacturing Company.

This committee headed by Mr. Robertson was initiated in Washington at the recent conference called by President Hoover (ELECTRICAL WORLD, September 3, page 289). The committee is immediately concerned with a plan to put back on payroll 1,620,000 workers out of employment in factories manufacturing machinery, equipment and plant facilities.

Concentration on an effort to get manufacturers in all of the nation's principal production centers to modernize their plants now, at a time when their machinery is in a run-down condition, financial and credit conditions are improved and purchase and installation costs for machinery are low, is the program.

"The committee believes," said Chairman Robertson, "that if industry will proceed now for reasons of sound self-interest to put its house in order and to remedy through modernization the run-down condition of its productive equipment employment will be created for hundreds of thousands of workers in the 'capital goods' industries. In addition, it will bring back on payroll hundreds of thousands of other workers in industries which furnish the parts, raw materials and services bought by the machinery and equipment manufacturers. This will release millions of dollars in wages spent for individual and family purchases affecting business in every community."

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Kelvinator to Emphasize Humidity Control

The Kelvinator Corporation is completing plans for the manufacture of a line of air-conditioning equipment, according to an announcement by George W. Mason, president.

"After nearly 20 years in the manufacture of electric refrigeration," Mr. Mason states, "Kelvinator feels that the time is ripe to enter this field with a product comparable to its refrigeration line. Merchandising plans are now under way. Addition of the air-conditioning unit to our line will enable the corporation to answer every domestic need in the field of air conditioning, refrigeration and heating. In perfecting the new equipment our engineers have attached particular importance to humidity control."

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Carrier Consolidates and Standardizes

Carrier Corporation, representing the consolidated interests of the old-line companies in commercial refrigeration, air-conditioning and industrial heating, is studying the question of sales of certain lines of products through dealers and distributors as part of a new sales program to take effect January 1.

J. I. Lyle, president of Carrier Corporation, has outlined plans for the unification of the various domestic sales divisions, formerly known as the Carrier Engineering Corporation, Brunswick-Kroeschell Company, Carrier-York Corporation and Carrier-Lyle Corporation. A single selling organization will be set up to handle all Carrier products. Certain of these will be distributed through dealers and contractors where their application lends itself particularly to this method and where the equipment is sufficiently standardized to permit distribution in this way. The larger central station type of air-conditioning systems for office buildings, theaters, department stores and public buildings which involve special application engineering will be handled direct, as heretofore, through a contract installation department.

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Assembling Profit to Go to Refrigerator Wholesaler

Based upon the acceptance that the wholesale distributor of electric refrigeration has never had sufficient profit allowed him properly to contact, cultivate and promote sales with his dealer trade the Republic Refrigerator Company of Detroit announces a revolutionary merchandising idea.

According to William Pace of the Republic company: "We are going to execute in actual practice the idea of decentralization of assembly and manufacture for lower costs and more satisfactory distribution of our product. Moreover, we are allowing our licensed distributors to make this assembling profit, something heretofore unheard of, but to which he is properly entitled. All experimental work and purchasing, as in the past, will be done at Detroit. All distributor shipments will go direct to the distributor's warehouse from the point of origin—no doubling of freight and cartage charges.

"The Republic plan," Mr. Pace further states, "is revolutionary in that the distributor pays exactly the same price for his merchandise that the Republic Refrigerator Company of Detroit pays for what it purchases. For the first time in electric refrigeration here is an opportunity for the wholesale distributor to reap a financial reward for his efforts. All wholesalers will be given an exclusive license for operations and buying power."

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Major New Construction This Week

TRANSFORMERS and accessories, motors and controls, regulators, switchboard apparatus, conveyors, etc., required for plant of New Amsterdam Brewing Company, New York, recently organized. Estimated $2,000,000.

Heavy-duty motors and controls, regulators, hoists and conveyors will be installed by Youngstown Sheet & Tube Company at Nemacolin, Pa., coal mines. Estimated $150,000.

Bureau of Yards and Docks, Washington, D. C., plans extensions and improvements in power plant at Charlestown, Mass., navy yard, cost about $100,000; also extensions and improvements in distributing system, $100,000.

Machine drives, motors and controls, regulators and conveyors needed by Gowanda (N. Y.) Plow Works, rebuilding following fire. Cost about $100,000

Fund of $123,000 being arranged by Atlantic, Iowa, for extensions and improvements in city-owned electric light and power station. Distribution system improvements to cost $25,000.

Transformers and accessories, motors and controls, regulators, electric hoists, etc., required for mill at Albany, N. Y., Co-Operative Grange League Federation. Cost about $100,000.

Texas-Louisiana Power Company, to rebuild part of generating station at Pilot Point, Tex., damaged by fire. Cost about $40,000.

525,000 Hp. in Electric Boilers

The capacity of electric boilers used by industrial customers of the Shawinigan Water & Power Co. will soon be increased by 143,000 hp. to a total of 525,000 hp. Three additional units, one just completed and two to be ready for operation before November 1, are involved. The 55,000 hp. electric boiler of the Consolidated Paper Corporation, Ltd., supplies up to 120,000 lb. of steam per hour, which is nearly sufficient to operate the entire mill. A 55,000 hp. electric boiler of the Anglo-Canadian Pulp & Paper Mills, Ltd., will be the second of its size in this mill.

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New York Metal Prices

	Sept. 6, 1932 Cents per Pound	Sept 13, 1932 Cents per Pound
Copper, electrolytic	6.00	6.25
Lead, Am. S. & R. price	3.60	3.60
Antimony	5.50	5.62½
Nickel ingot	35.00	35.00
Zinc, spot	3.50	3.85
Tin, Straits	25.25	24.125
Aluminum, 99 per cent	23.30	23.30

Judson King Backs Roosevelt

Contending that "President Hoover would continue to oppose public plants, lease our remaining great power sites to private interests for 50 years and support inadequate laws to regulate holding companies," while "Governor Roosevelt would continue in Washington the power policies he has fought for in Albany," Judson King, director of the National Popular Government League, in a pamphlet issued this week backs the Roosevelt candidacy. The statement bears the indorsement of league members.

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Utilities File Counter Petitions

Counter petitions, asking increased utility rates in five cities which have opened rate reduction cases, have been filed with the Indiana Public Service Commission by the Public Service Company of Indiana and the Northern Indiana Power Company. The cities involved are Noblesville, Columbus, French Lick, West Baden and Wabash. In each case the companies declared that rates now charged are too low, rather than too high, and asked the commission to make an examination with a view to establishing new rate schedules.

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Empire State Meeting Off

The annual meeting of the Empire State Gas and Electric Association, scheduled for September 22-23 at Saranac Inn., N. Y., will not be held this year.

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Frigidaire Prices Reduced

Announcement by Vice-President H. W. Newell of the Frigidaire Corporation of a Frigidaire domestic refrigerator to sell completely installed and tax paid for $112 (plus freight) has been made. Coincident with the price change a new type of cabinet construction giving one-fourth more food space and a two-cylinder compressor are announced. Price reductions on other lines run from 5 to 20 per cent. Apparently Frigidaire is not to be undersold.

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Oregon Security Sales

The Oregon Corporation Commissioner has formally notified the following that, in his opinion, they are evading the provisions of the blue sky law by attempting to deal in securities sales and transfers without first receiving state permits: Central Public Service Corporation, Central Gas & Electric Company, Southern Cities Public Service Company and Southern Cities Public Utilities Company (ELECTRICAL WORLD, August 27, page 261). The security issue in question involves reorganization practices affecting the Oregon properties of the Central Public Service Company and its parent operator, the Portland General Electric Company. Statements issued by these companies are to the effect that there has been no attempt made on their part to sell securities, but merely to absorb outstanding debentures the reorganized firm known as the Central Public Utilities Corporation undertakes to underwrite.

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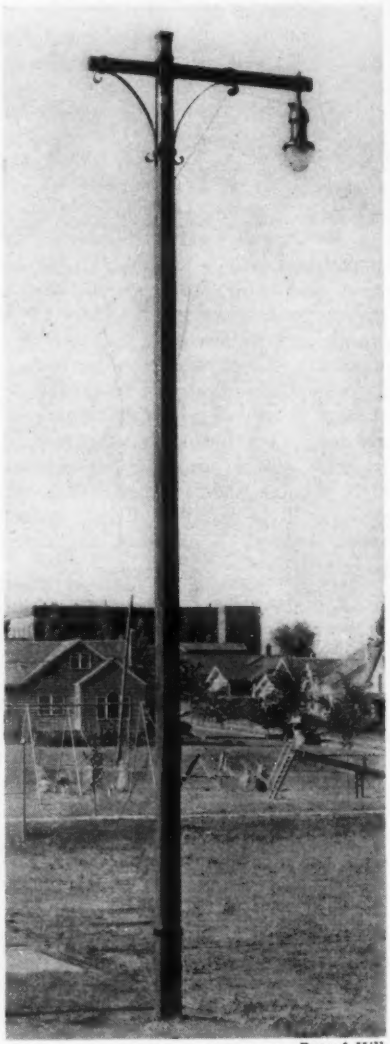
Modern Wood Poles



Page & Hill

This 30-ft. cedar heartwood pole adopted by the Minneapolis (Minn.) park system appears to mark a new era in wood-pole practices. Such tapered, chamfered-corner, plane-surface-hand-edged standards and conductor supports are available for locations where ornamental effects are desired. Advantages are said to be low first cost as compared with other ornamental standards, long life, low installation cost, light weight and elimination of concrete bases. Conductors on light standards may be brought up through the center of the pole. A number of variations have been developed.

Receiver Asked for Abitibi Power

Montreal Trust Company in a writ issued against the Abitibi Power & Paper Company, Ltd., has asked for administration and execution by the court of mortgage trusts made June 1, 1928, with the Montreal Trust Company and the National City Bank of New York. The plaintiffs ask payment of principal and interest. It is sought to declare that the mortgage is a first charge on all property and assets of Abitibi. The court issued an order naming G. T. Clarkson of Toronto receiver and manager with powers to borrow money from time to time to protect the assets and carry on the business of the company.

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Federal Tax Vote in Mass.?

Massachusetts voters in 28 representative districts will have the opportunity at the November election to indicate their desire for or against the repeal of the federal tax on electrical energy use. Attorney-General Warner has approved the placing of the question on the ballot as properly relating to public policy.

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Doniphan Stock Sale Restrained

Doniphan Hydro-Electric Company has been warned to stop offering its stock for sale in Missouri by the state securities department. Officials of the department hold the stock to be unregistered and that an application for registration has never been received. The stock offered was to raise funds for preliminary construction work on a proposed hydro-electric project on Current River at Gartman Rock, near Doniphan. Petition for the rehearing of its application to the Federal Power Commission covering this construction work was recently filed (ELECTRICAL WORLD, August 13, 1932, page 194).

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Gary Utility Rebuked by Commission

Gary (Ind.) Heat, Light & Water Company, already defendant to allegations of excessive rate charging emanating from its consumers, has received an official rebuke from the Indiana Public Service Commission for "juggling figures" in its annual report to the commission. The company was ordered to decrease the net income account shown by $40,000 and to add that figure to depreciation. The commission charged that the company had wrongfully taken this sum from its electric property depreciation fund and used the money to show a greater net income on paper. This alleged practice, the commission asserts, was "deceiving to the public since it did not rightfully inform the public of the actual operating expenses during 1931."

British Association Hears of Zero Resistance

Solemnly assembled at York, England, for its annual meeting, the British Association for the Advancement of Science heard, during a discussion of superconductivity of metals, of a phenomenon which has been spoken of less openly for some time. Apparently it represents the realization of the equivalent of perpetual motion. Taken up by the British association, it acquires new dignity.

Last year in a laboratory at Leyden, Holland, it is reported, a current was started in a ring of lead cooled in a flask of liquid helium. Twelve hours later, after the flask had been brought to London by airplane, the current was still coursing through the ring without any apparent loss of strength.

"There is simply no resistance to the current," said Prof. J. C. McLennan, Toronto physicist, in telling of subsequent experiments. "When metal reaches a certain temperature resistance suddenly and abruptly vanishes. It is practically perpetual motion. Since the Leyden experiment I have watched the ring's behavior for thirteen hours, and at the end of that time I found the strength of the current had not dropped 1 per cent or even one-hundredth of 1 per cent.

"I am convinced it could go on for a week if a low enough temperature were always maintained—and possibly longer. In the case of lead the temperature at which resistance vanishes is 446.8 deg. F. below zero. In the case of certain alloys the vanishing points are not so low.

"So far," said Professor McLennan, "we have been able to raise the vanishing point perhaps 50 deg. F. by trying other metals. But that leaves more than 400 degrees still to go, and it is unlikely we can ever do away with resistance at normal temperatures. It is just a mad dream. The importance of superconductivity lies not in its nearly perpetual motion but in the light it must throw on the structure of solids. We know next to nothing of the mysterious power which holds solids together. Now with this phenomenon in solid metal we find an answer."

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Pre-Set Show Window Control Developed

Show window curtains which day after day will open and close and show window lights which night after night will go on and go off—all without the necessity of any human controlling hand—will be unusual features of the new Wanamaker men's store, Philadelphia. The store is scheduled to open early in October and will be the largest of its kind in the world.

Curtains and lights will be operated by a device which basically consists of a vertical cylinder with numerous small holes arranged in spiral sequence on the surface, and an electric clock which controls the revolutions of the cylinder. The clock is synchronized with the Philadelphia Electric Company's system.

Each of the holes on the cylinder corresponds to a certain minute of the day or night. Insertion of a pin in any hole will cause an electric circuit to be closed as the revolution of the cylinder brings the pin into contact position. Such contact either turns on or off the lights in a series of show windows, or sets in motion a series of the 1/30-hp. motors—two to a window—which open or close the curtains.

Days of the week on which the lights and curtains are not operated, or on which they are operated earlier or later than usual, are provided for by what is known as a calendar drum, which shifts at the pre-set time and changes the usual schedule.

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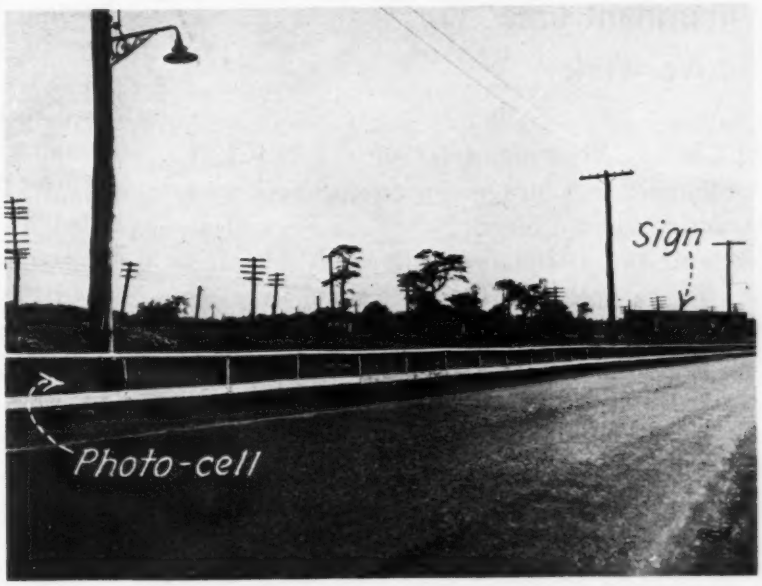
SIGN LIGHTED ONLY WHEN USEFUL



No wasted energy whirls the meter that measures the electricity used on this roadside sign near New Haven, Conn. When the headlights of an approaching car shine on the controlling, experimental photocell mounting the sign lights go on. Under prolonged illumination, such as daylight, the circuit is broken. Result, more brilliant lighting can be had at useful times without any increased cost for electrical energy.

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Full Air Conditioning for 33-Story Building

In the new 33-story bank and office building of the Philadelphia (Pa.) Saving Fund Society full air conditioning with humidity control has been incorporated. This structure, now nearing completion, will have a total motor load of 3,620 hp., of which 64 per cent is required for air-conditioning and air-circulating equipment.

Planned on the basis of "nothing more modern," the new age touches are everywhere in evidence; elevator service is 20 per cent faster than that usually found in similar structures, outside wall areas are 65 per cent glass, an artificial indirect lighting plan allows a normal 19 foot-candles, electric service is provided at 13.2 kv. from two independent services, two normally isolated bus structures are automatically linked in the event of feeder failure, automatic interlocks prevent inadvertent paralleling of service feeders on high- or low-tension sides and induction regulators have been omitted.

An interesting departure is the use for low-voltage buses and distribution risers of flat copper spaced, insulated and supported by flat sheets of composition insulating material. Main vertical distribution circuits are carried in steel raceways from the basement to the 32d floor. Here the flat copper conductors are guided and spaced similarly with sheet insulator spacers every 4 ft. and the weight supported by vertical sheets of insulating material at the middle of each 120-ft. section. Woven copper straps take care of the expansion of sections.

EDITORIALS

L.W.W.MORROW
Editor

An important time for active work

TECHNICAL committees of the N.E.L.A. will meet in Chicago during the first week of October. These meetings should be well attended and the attendance will surely be satisfactory if the optimism that is welling over the country affects the puckerers of utility purse-strings proportionately. Certainly there should be no repetition of the sad spectacle of one of the technical committees which at its last meeting had two of its roster of fifteen present. Maybe they would not even have been there if they had not had papers to present. Outside of the 47 visitors (of whom 28 were local utility non-members, eleven manufacturers' representatives, two professors and six from out-of-town utilities) there would otherwise have been only the chairman, vice-chairman and counsellor to uphold the dignity of the committee.

Revision of the constitution of the association and a new profession of service to the utility industry should be taken verbatim in facing the problem of spending tight money for convention attendance. If the N.E.L.A. is to concentrate on specific service to utility management the energy it once applied to broad and diffusive national problems there is no better way of turning a creed into a deed than to send the experts and their lieutenants to gatherings where exchange of ideas in their nascent state always anticipates by months the presentation of those ideas in formal papers in bulletins and reports.

A new era in technical fields is certain to mark the second half-century, signaled in its opening by a depression which has realigned all values. If the industry has half the courage that general business has concocted for itself in the last two months the association meetings will be generously attended by men on the firing line. They need to know promptly what their confreres are thinking they will have to do by way of strategy to meet new obstacles with new weapons in a new terrain.

High-voltage d.c. transmission

EVER since the troublesome phenomenon of a.c. circuits began to be known and studied there was a subconscious desire in the mind of every electrical engineer to find a way to transmit energy at d.c. over long distances. The series system of Thury, which gave many years of comparatively successful operation between St. Moritz and Lausanne, did not find many disciples. Then came the mercury-arc rectifier, and for some time there was great hope that this invention would eventually make d.c. transmission practical, but even though the rectifier was developed into a very competent and very useful device, it did not result in d.c. transmission.

Then came the vacuum tube with its various ramifications, making it possible not only to rectify but also to invert, and again there was hope all around for d.c. transmission, but so far it has not resulted in any real practical d.c. transmission line.

And now Erwin Marx reports in the *Elektrotechnische Zeitschrift,* August 4, 1932, issue, that a new device has been developed at the Technical University of Brownschweig which can serve both as rectifier and inverter and by means of which rectification and inversion were actually accomplished at 140,000 volts and 180 amperes with an over-all efficiency of 98 to 99 per cent, and

that experiments were successfully carried out up to 150,000 volts at 5,000 amperes and the same efficiency. This is 760,000 kva., single phase! Is d.c. transmission really in sight? Or has the idea arrived just a little too late due to the present tendency of generation at load centers?

The increasing importance of rural rates

INTENSIVE development of rural loads is fundamental to profitable service in this field. In the latest report of the New Hampshire Agricultural Experiment Station, entitled "Electricity on New England Farms," the project director, W. T. Ackerman, introduces some interesting and thought-provoking comments on the subject of rural rate essentials. He points out that while in the past rural consumption has been low in energy consumed per month, this will probably be increased considerably in future. The necessity for inducement rates which encourage farm power applications therefore becomes of increasing importance. Consideration of the characteristic demands of farm service as contrasted with those of city, suburban and country residences is highly desirable at this time.

The report cites the inconveniences of arbitarily trying to separate rural residential users of electricity from farm customers and suggests that, instead of making this division, the two classes be thrown together in one rate, starting with the rural resident as the base unit and separating the rate structure so that only the actual putting of electricity to work in farm operations of appreciable size will bring the consumer into the position of securing the low block charges. The true farm customer offers the power company a combination of residential and wholesale "manufacturing" or processing load, and little argument is needed to show the equity and importance of inducement rates for such takers of service.

Since large bulk use of energy is desired and necessary to produce the proper return on the line investment, as well as to justify lower rate steps, it would seem that a farm rate structure should have a predominant part devoted to the power (wholesale) basis, but the proportions will naturally be fixed by extended study of the billings and uses of a large number of customers, rural line extension costs and equipment economics. It is pointed out that in some cases demand charges on motors used intermittently tend to discourage their application and even to cause their abandonment in favor of gas or oil engines.

Just how the rural demand shall be measured is another important question, and Mr. Ackerman's suggestion that transformer ratings be thus considered is well worth investigation.

Inexpensive demand metering needed for small loads

WHAT really matters in connection with recovery of costs that arise from readiness to serve is not the commercial connected load or a house area or a number of rooms. It is the actual demand created from month to month by the user. The demand meter, therefore, is the ultimate destination toward which appliance enumerations, area measurements and room counts are merely way stations. These are serving their purpose well, but nevertheless it is manifest that their adequacy is raised in question the more rapidly energy block rates are lowered and the more prominence the fixed charge assumes in consequence.

Small commercial loads, and residential loads too, are nearing power loads in their urge to measure all aspects of service costs. The line between metering and guessing has moved to lower brackets. The obstacle to executing the desired result is merely one of cost, cost of the requisite device and cost of administering it. To add to the cost of the watt-hour meter, which itself is always on the verge of critical scrutiny by operating executives, the present cost of demand attachments is something small loads could hardly bear. But that is no reason why the subject should not be given prompt and thorough study by both meter manufacturers and utilities.

An inexpensive device for demand measurement will before long be needed to match the progress the consuming public has made in accepting temporarily, but not permanently, the prevailing methods of estimating its electrical demands. Broadly speaking, the lay public has more confidence in a meter which is intimately related to its electrical usage than in expedients which at best only approximate their maximum usage.

Selling Ranges with Trade Co-operation

MORE than 95 per cent of the 110,000 families represented in a recent cross-sectional survey of residential service on the West Penn Power Company system are without electric ranges. The survey organization, J. David Houser & Associates, interviewed more than 2,500 families in order to get a true picture of all but the poorest 30,000 families of the 140,000 on the company's lines. The appliance market shows little evidence of saturation aside from electric irons, vacuum cleaners, washing machines and radios, and even here the replacement market is extremely attractive on any item having more than 50 per cent saturation.

In the company's opinion the electric range market is now like the automobile market in 1915, when there were but 2,000,000 cars on the road and when motors for personal use were viewed as luxuries of the rich or the extravagant. To capitalize this situation the West Penn company is carrying on a permanent campaign in range sales through trade co-operation and the major features of this work are of much interest.

Range attains seasoned commodity status

The company's co-operative plan is based upon the arrived status of the electric range. Already more than 1,000,000 are in use in this country and 5,000 families on the West Penn system are thus equipped. Nearly all are enthusiastic users, but as yet the public has not become "electric cooking conscious" in the same sense that it has accepted electric refrigeration. In only 69 cases out of 1,827, the survey showed, were recipients of electric appliance advertising on the West Penn system confessedly interested in electric range promotional and product "literature," as against 399 in better lighting and 411 in general appliances. The company is convinced that the time has come to press home the advantages of electric cooking assured by recent improvements in ranges, available rates for energy, attractive prices and terms of sale and opportunities for mutual gain through co-operation among manufacturers, jobbers, dealers, contractors and the utility organization.

In announcing its co-operative plan the company prepared a 50-page pamphlet entitled "Profits from Plowing," which sets forth the major results of the Houser survey, outlines the market for various household appliances and announces the details of co-operation established by the power company and its policies in encouraging merchandising development. It points out that today the electric range is as fast in its operation as any fuel range; its first cost has been reduced until it is comparable with any good cooking machine, and that the cost of operation has been reduced to a completely practicable figure. Thus the stage is set for consumer acceptance, and by providing adequate service entrance as a part of its own facilities and an extremely low installation price of $7.50 the company believes that it has leaped the one remaining barrier to wider use of electric cookery.

In the spring of 1930 the company announced it would install as a part of the utility facilities three-wire, 60-amp. entrances to serve electric ranges and at the same time put into effect a new 1¾-cent block in its domestic rate. This opened up new markets for electric cookery in its territory. These steps were followed by aggressive promotional work, including electric cooking schools, newspaper and direct mail publicity, organization of a home economics department with expert personnel available for range demonstrations and co-operation with interested dealers in various other ways. Meanwhile, manufacturers continued to improve the appearance and efficiency of their ranges and reduce their prices.

The result of this development work was an increase in electric range sales in West Penn territory of about 500 per cent in 1930 over 1929, sales in that year reaching 1,900. Sales in 1931 totaled 1,650, and in 1932 to June, 500. The percentage of dealers doing a satisfactory job in range sales has increased slightly of late, but the company believes that the increase would be material were business conditions to improve.

These results are not presented because they are unusual but because any success is extremely encouraging when past experience with selling electric ranges has been none too satisfactory. More important is the fact that the West Penn Power Company has faith in its co-operative plan, believes it is fair and that it will produce results in the long run as more dealers become acquainted with its merits and the advantages to the public of electric cookery.

The standard service entrance consists of a bare No. 6 and two No. 4 wires in 1-in. conduit for a range connection and is installed free regardless of where the customer buys his range. The main switch, included as a part of this entrance, is provided with a range circuit switch and 40-amp. fuses as well as provision for two three-wire, 30-amp. circuits for water heater and future heating service. A cord, plug and polarized receptacle are also furnished free with each range installed.

The usual and average length of run from the main switch and meter board to the range is 20 ft.; the minimum is 6 ft., and the maximum from 50 to 150 ft. In case the run is more than 50 ft. at least No. 6 wire is required for the circuit.

So that range users may move a range from home to home, or out from the wall for cleaning, with the minimum trouble, inconvenience and expense, the West Penn Power Company has standardized on the General Electric receptacle (installed at the floor or on the baseboard) and its combined flexible cable and plug (all No. 368210). Several jobbers (Graybar, General Electric, Iron City and Doubleday-Hill) have agreed to furnish the combined cable and plug as a part of all ranges sold by them to dealers in this territory. In co-operation with this step the West Penn company has agreed to furnish the receptacle, without charge, to any dealer or contractor

West Penn's electric range sales plan treats the dealer as though he were a member of the utility organization in giving him intensive training, data on market conditions, home economics service, co-operative publicity in cooking schools and advertising guidance.

Fair competition is the keynote of the company's policy.

Low installation costs, low rates and attractive sales terms are bringing electric cookery to the residence customer's favorable attention.

Although the plan is young, it is making rapid headway in the western section of the Keystone State.

providing it is used in the installation of a range in its territory.

In a few cases in the last two years the cost of installing the heavy-duty service entrance has not been justified by the additional revenue, and here the customer has paid a portion of the expense. The entrance service is provided as a part of the company's plant facilities and applies to old dwellings as well as to new ones. Usually it is installed by power company men, except when they are too busy, in which case contractors make the installation of the service entrance. When contractors install the service entrance it is usually at a flat price, with the company furnishing the material, including the main switch. The only exception to a flat price for contractor installations is in difficult situations where the contractor first furnishes an estimated cost.

West Penn usually installs the range interior house wiring because the cost of so doing is less than when the contractor does it. This is so because the company employees must go to the customer's property for the delivery and erection of the range anyway. The distance from headquarters is excessive. Therefore, these same employees complete the total installation including the wiring. Were this not so, the contractor would have to make a similar trip for the installation of the wiring circuit only, causing duplication of automobile expense and lost traveling time, which, combined, makes a material difference. In most cases two men take the range, deliver it, erect it, run the necessary range circuit, install the new meter and new service entrance and install the new service drop connection all in one trip, with corresponding saving in automobile expense and traveling time indicated above.

The installation of the range itself and range circuit are almost invariably made by company service men, although occasionally some contractors, when installing a service entrance, install the range circuit.

All energy above 150 kw.-hr. per month is billed at the 1¾-cent rate. The company's domestic rate is in four steps, the size of the block varying with the number of rooms. For the average size of home (seven rooms) the first 15 kw.-hr. is billed at 8 cents net; 20 kw.-hr. at 5 cents; 115 at 3 cents, and the excess as given. Practically all range installations are served at 3 cents maximum, with most of the users getting 25 per cent or more of their usage at 1¾ cents.

Advertised range prices are list plus $7.50 for installation. The installation includes cord and plug, delivery, setting up and testing the range and the installation of the circuit between the main switch and the range, including the receptacle. If the customer already has a range circuit and receptacle installed the price is list.

The service entrance wires and main switch and panelboard are installed as an extension of the company's distribution plant facilities. The expense necessary to connect the customer's previous wiring with this new service entrance is charged to new-business expense and seldom amounts to more than a dollar or two, and then only when the customer's old distribution panel is at a distance from the new main switch. The cost of the range circuit is paid for by the customer and is included in the installation charge of $7.50.

Because the investment in the service entrance is included as a part of plant facilities, the $7.50 covers the average actual cost of installing the range and the range circuit, particularly as the cord and plug are supplied by most range distributors to the dealers in this territory free with the range, and West Penn furnishes the polarized receptacle free.

The prices indicated are for cash. When time payment is involved a definite carrying charge of 3 per cent plus ½ per cent per month on the deferred balance is added, with 10 per cent as the minimum down payment. (This carrying charge is equal to or in some instances slightly more than the usual finance company's rates.) A deferred payment of 24 months is allowed on the lower-priced ranges, which finance companies do not include in their plans. Therefore the West Penn company has offered to carry dealers' paper where its terms in any respect are more liberal than what they can get from the Commercial Investment Trust.

Where dealers accept this plan, which at the best would apply to only part of their sales (as C.I.T. offers them the same terms as West Penn on the higher-priced ranges) the power company collects just as it does for itself.

The West Penn company operates 43 stores, or about one store for every 3,260 domestic customers. About 125 company salesmen (one per 1,120 customers) are in the field, most of the store floors being served by a girl clerk. The average annual revenue per residential customer is about $33, with an annual energy consumption of 655 kw.-hr. Company salesmen operate on a straight commission basis. Each covers an assigned territory and sells the entire line. The commission set-up works, however, to emphasize the load-building items such as ranges, water heaters, refrigerators, radios and ironers. The home economics department at present consists of a director, assistant, clerk and seven field girls.

Dealers given same encouragement as company men

Broadly speaking, dealers who satisfy the company that they are willing and competent to do a complete sales job on ranges are given the same aids as company employees in merchandising. The results of the range-use survey have been made available to them. The home economics department will demonstrate a range on a dealer's request and will follow up the sale as if it were its own. The girls of this department also answer complaints and advise the dealer as to the character of these complaints. Physical changes in the range installation are referred to the dealer, if required. Copies of the re-

ports that the girls make out on dealer demonstrations and complaints are sent to the dealers.

The same sales training facilities are offered to dealers as are given to employees of the West Penn company. Up to May 1 last about 70 dealers, dealers' salesmen and jobbers' salesmen in groups of four to six have spent a day in the company's range school.

West Penn range schools cover only one day's instructions because that is the maximum at one time that the men will devote to this purpose, although they are encouraged to repeat. In addition, the real purpose of the school is to give the men confidence in the simplicity of electric cooking operations. They are actually required to put on an apron, prepare food and use the ranges. This inspires confidence in their ability and in the company and thereby puts the latter on a footing to be of further assistance to them in helping them solve their specific sales problems as they arise.

Co-operation is given in planning advertising and the power company's files of data on electric appliance problems are open to dealers. The company maintains a wiring service bureau which co-operates with contractors, dealers and architects.

Opportunities for self check-ups on the power company's policies are offered dealers. These bring to the dealer's attention the opportunities for capitalizing on advertising, making use of the home economics department, securing sales training, the service entrance policy, special sales propositions, appliance testing and scrutiny, rate schedules as a preparation for discussing operating costs and electrical characteristics of appliances.

Cooking schools avoid propaganda

Three-day cooking schools are conducted by the power company under the auspices usually of a local newspaper, but at times of a woman's club, church society or American Legion auxiliary. These are almost strictly educational. Direct advertising is held to an absolute minimum. Thus, in talking about the three different kinds of ranges on the platform no mention is made of the maker's name or of the fact that West Penn sells these or other ranges. The schools are largely devoted to electric cookery, modern kitchen practice, proper utensils, a small amount of electric refrigeration practice, kitchen layouts and cooking methods. Reference is made to the co-operating dealers, thanking them for their participation, and in the question-and-answer period the fact that they handle electric appliances is brought out.

These schools are so educational that where the home economics teacher of the local school has attended, it has usually been necessary to make arrangements for her entire classes to attend the additional sessions, and in some cases special sessions have been arranged for school children. The company has proceeded on the idea that women are getting tired of the advertising "chatter" of the ordinary cooking school, of which there is none in the West Penn schools. The dealers, after their first experience, are enthusiastic and appreciative of the co-operative publicity. No salesmen are allowed to be present at the public cooking schools nor are the names of those in attendance kept for a personal follow-up. The company co-operates with local newspapers in getting advertising and in arranging for dealer exhibits.

As dealers come to realize the policies of the company, their desire to co-operate increases and it is generally recognized that the company intends to merchandise only on a basis of fair competition. The company devotes considerable space in "Plowing for Profit" showing dealers how to benefit from co-operative advertising and from the promotional an dproduct advertising of the company. Company wiring and layout men help prepare Red Seal home layouts and aid contractors and dealers to market this idea to the public.

Trade relations are friendly

The West Penn company recognizes as the proper retail cash price of any appliance which it sells an amount which allows any logical retail outlet (selling at that same price) a gross profit not less than such retail outlets customarily obtain from their discount on such items. This does not invalidate selling certain items temporarily at special prices in the interest of load building or sound merchandising, but where such special prices are established on any item the company will make the necessary arrangement so that the item may be purchased by any logical retail outlet at that outlet's customary discount, applied to this special price, subject to the manufacturer and distributor's usual credit, franchise, sales and other conditions applying to their regular sale of such items. This does not apply to shopworn, repossessed, damaged or obsolete items.

West Penn uses its own deferred-payment plans, which have been made to conform to those generally available. The company does not sell on open account, all of its sales being either for cash or on its deferred-payment plan, and does not include the amount due for merchandising in its bills for electric service. Its merchandise bills and statements are separate, with different billheads, but may be mailed in one envelope with the service bill for the customer's convenience.

The jobbers in West Penn territory have formulated a statement of dealer policy on range sales which the power company recognizes and approves. This includes keeping at least two ranges (one high-priced and one low-priced) on the floor of the store, connected to a live circuit; prompt replacement after sale; learning the story of electric cookery; understanding rate schedules and operating costs; maintaining suggested prices plus the connection charge; making no allowance for old ranges; two direct mail advertising sendouts per year of at least 100 names each; six weeks' minimum use per year of range display material per year; training of dealers' service men in range installation and servicing. Each dealer is given a reasonable annual quota which he is expected to meet. The West Penn company believes that all range dealers and their salesmen should use electric cookery in their own homes. More than 800 West Penn employees or about 50 per cent of those living in territory served by the company now do this.

West Penn desires to encourage dealers to deal with distributors and therefore grants to a dealer only a 20 per cent discount if he purchases ranges from its stock. In a few cases a commission has been paid to a dealer where he appeared unusually promising as a future electric range merchandiser. The development of electric range dealers is still in an incomplete stage. In 1929 the dealers sold about 25 ranges, in 1930, 75, and in 1931 about 150. The company does not desire to multiply these sales outlets faster than good merchandising dictates is wise. At present about 15 per cent of the dealers are doing a fully satisfactory range job, and future developments are still to be defined. Ultimately the

company wants at least 75 per cent of all establishments offering cook stoves of any sort for sale to at least display electric ranges.

There are 1,300 dealers who are selling items of some electrical nature from lamp bulbs up. There are in the neighborhood of 300 dealers whom ultimately the company would like to see handling electric ranges. At the present time there are 90 dealers who consider themselves electric range dealers.

The West Penn company does not seek to compete with wiring contractors in the installation of wiring. To this end, where Red Seal wiring is being installed (in all new buildings and certain old ones) the power company will furnish its standard 60-amp., three-wire combined meter switch and distribution panel to the contractor without charge; will pay $20 to the contractor for each such installation (if the installation passes Red Seal requirements—an electric range is accepted in lieu of these requirements), and will furnish without charge its standard receptacle. This inducement is effective in stimulating adequate wiring and use of electric ranges as it becomes more generally known.

The dealers service ranges on the terms which the manufacturer establishes. In replacement of parts and labor costs the dealers are being encouraged to charge regular prices. West Penn's charges for service are $1.50 per hour, no automobile mileage and the material, when outside of guarantee, at the manufacturer's list.

▼

Secondary "Doubles" as Primary to Reduce Distribution Costs

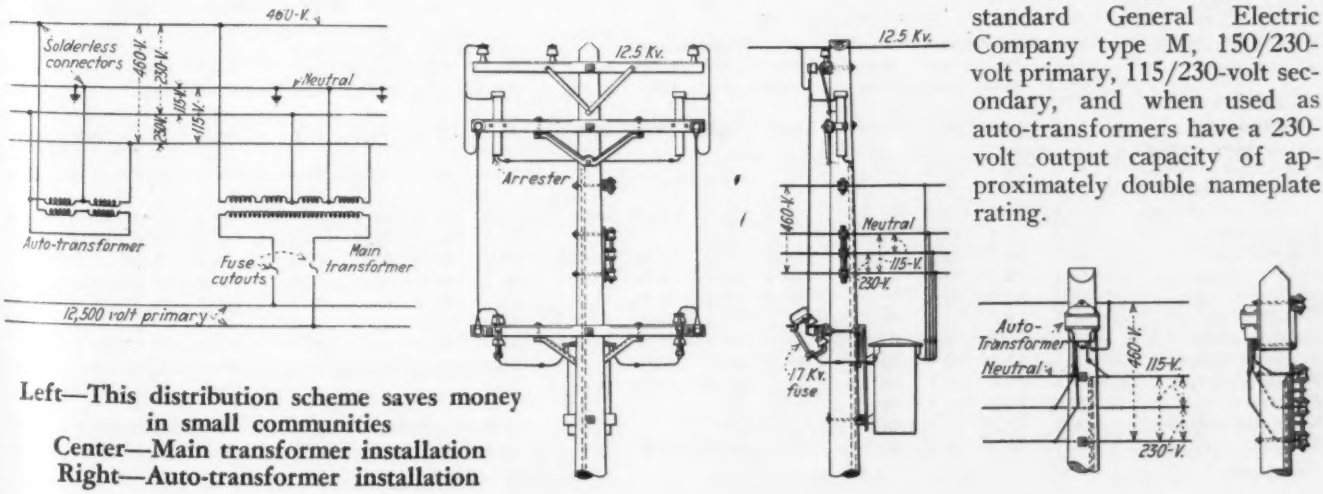
Scattered dwellings spaced several hundred or more feet apart and whose loads are characteristically large per customer unit put the distribution problem of the average small rural community in a class quite distinctly its own. Customer density is not sufficiently high to allow the use of usual urban distribution practices nor is it so low as to make farm line distribution methods wholly practicable. Regulation and service suffer if large area secondary distribution is attempted and costs run up if secondaries are kept short by increasing the number of primary runs and transformer installations.

Escape from the horns of this dilemma was found by the Texas Power & Light Company by making the secondary of a main transformer serve as a low-voltage primary as well as a secondary. This system has so far been applied in twenty small communities on the T. P. & L. lines and has demonstrated a saving of 10 to 15 per cent in the initial investment for distribution in these towns. So satisfactory has the system proved itself that consideration is being given to its use in the outskirts of larger communities to reduce the necessity for sometimes long and expensive primary extensions.

The system rests upon one single-phase transformer which is installed in the load center of the community and which feeds the load in its vicinity at 115/230 volts. The transformer has a 460-volt secondary with the lower voltage taps brought out. The 115-volt tap is used as the neutral and is grounded. The 460-volt leads are run out to near the edge of the load and a dry type one-to-one ratio, 230-115/230-volt insulating transformer is installed. The primary and secondary are connected in series, thus providing an auto-transformer to feed from the 460-volt source into the 115/230-volt secondary. The neutral derived from the auto-transformer is grounded.

The voltage regulation at services is surprisingly good. The drop with 460 volts is of course one-fourth as much as with 230 volts and one-sixteenth as much as with 115 volts for a given size of conductor. Calculations indicate that an electric range can be served at a distance of a mile from the main transformer if the auto-transformer is installed on the service pole. As stated, about twenty of these systems have been installed with very satisfactory operating results.

On the first installation the 460-volt legs of the auto-transformers were fused. However, it was found that under certain conditions high voltage on one side of the 115/230-volt secondary was obtained with one fuse blown. The auto-transformers are now connected directly to the line without fuses. About six auto-transformers have been burned up, three from overload and three from lightning. To date lightning arresters have not been placed on the 460-volt transformer installations, but are being considered. Two sizes of main transformers are used, 15 and 25 kva., and two sizes of auto-transformers, 3 and 5 kva. The auto-transformers are standard General Electric Company type M, 150/230-volt primary, 115/230-volt secondary, and when used as auto-transformers have a 230-volt output capacity of approximately double nameplate rating.



Left—This distribution scheme saves money in small communities
Center—Main transformer installation
Right—Auto-transformer installation

Some Industrial Gains in August, but Also Losses

Evidences of increased industrial activity are to be found in the August returns on electrical energy consumption, but not without a search, for the general average continued downward. It declined 6 per cent compared with July and was down 27 per cent from last year's August.

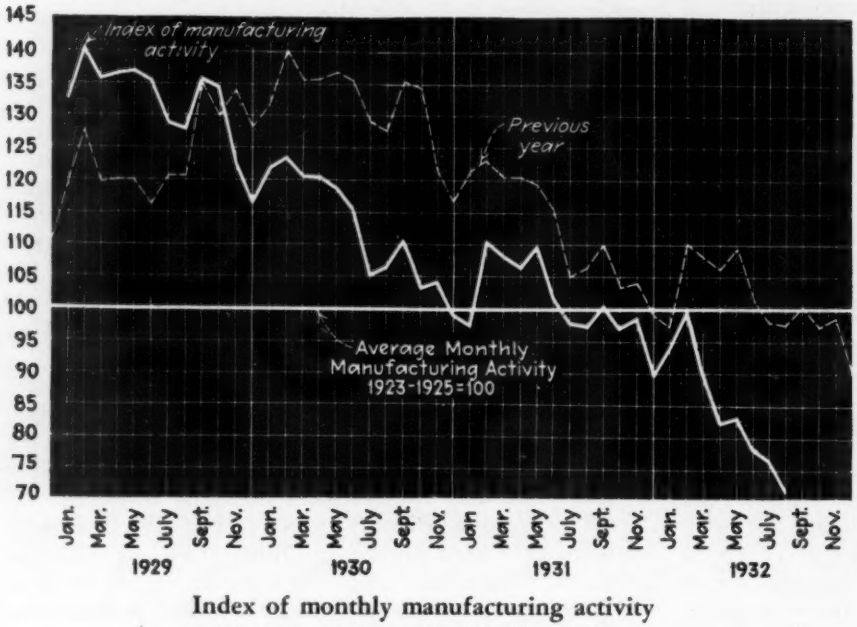
The index numbers in the accompanying table are computed on the basis of 25 working days in July, excluding Sundays and holidays, and 27 in August. For comparison they are adjusted to a standard of 26 working days. Unadjusted, the August index is somewhat higher than that for July, 74.2 against 73.5. The inference is that total production was greater in August. Average daily activity, on the basis described, was lower.

In any case, appreciable gains are revealed in textiles and leather products. This confirms announcements of increased employment in those branches. Thus, while the national average for textiles remains much lower than at this season last year it is 15 per cent higher than in July, 13 per cent above June and about on the level of May. These changes are in marked contrast with the 5 per cent decrease from June to August last year. In New England there was a rise of 27 per cent from July.

Leather products advanced 4 per cent, against a decline of 8 per cent from July to August in 1931. Here also the increase was general in the major industrial areas, except New England. That section had a rise of 19 per cent from June to July.

Food products receded somewhat, but that industry remains on a relatively high level. The same holds for chemicals, but here the favorable showing may be due in part to continued activity in oil refining.

Outweighing the gains, the most pronounced decline was in the automobile group, off nearly 40 per cent from July. This is consistent with the data on Detroit factory employment now available for the first half of August. A further sag appears in the metal industries, which thus far continue on their downward path.

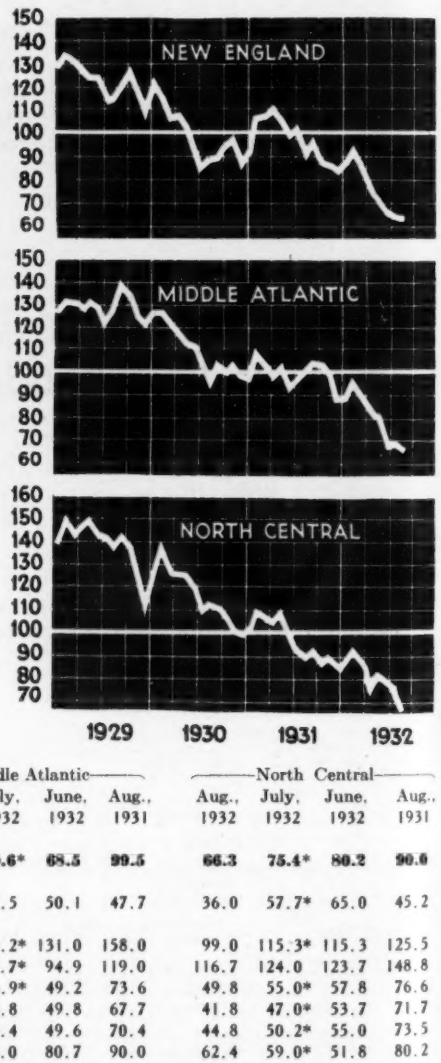


Index of monthly manufacturing activity

Base: Average month 1923-1925 = 100.

(Corrected for number of working days, but not for seasonal variation.)

These data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 3,800 large manufacturing plants in various industries and scattered throughout the country.



Industrial Group	United States Aug., 1932	United States July, 1932	United States June, 1932	United States Aug., 1931	New England Aug., 1932	New England July, 1932	New England June, 1932	New England Aug., 1931	Middle Atlantic Aug., 1932	Middle Atlantic July, 1932	Middle Atlantic June, 1932	Middle Atlantic Aug., 1931	North Central Aug., 1932	North Central July, 1932	North Central June, 1932	North Central Aug., 1931
All Industry	**71.5**	**76.3***	**78.1**	**97.3**	**63.8**	**65.2***	**67.3**	**89.9**	**66.7**	**70.6***	**68.5**	**99.5**	**66.3**	**75.4***	**80.2**	**90.6**
Automobile (including parts and accessories)	36.0	58.5*	65.9	43.6	.....	.....	.....	.....	36.6	47.5	50.1	47.7	36.0	57.7*	65.0	45.2
Chemical products (including oil refining)	115.8	124.9*	123.8	137.6	119.8	133.2*	143.0	140.5	124.0	134.2*	131.0	158.0	99.0	115.3*	115.3	125.5
Food products	114.2	122.0	118.4	146.4	.....	.....	.....	.....	91.5	99.7*	94.9	119.0	116.7	124.0	123.7	148.8
Iron and steel	46.8	53.3*	55.8	78.0	75.7	85.3	79.4	108.0	38.8	46.9*	49.2	73.6	49.8	55.0*	57.8	76.6
Metal working	45.8	50.2*	53.0	73.3	54.4	62.3*	68.5	87.5	47.1	50.8	49.8	67.7	41.8	47.0*	53.7	71.7
Metals group	46.3	51.3*	54.1	75.0	60.4	68.8*	71.5	93.3	43.5	49.4	49.6	70.4	44.8	50.2*	55.0	73.5
Leather products	76.5	73.7	65.7	77.1	70.7	72.8	61.2	68.7	90.0	86.0	80.7	90.0	62.4	59.0*	51.8	80.2
Forest products	68.5	69.2	70.0	79.4	33.4	37.2*	43.9	47.2	51.8	54.4*	48.1	80.3	74.9	67.7*	71.5	79.1
Paper and pulp	88.5	94.5*	95.8	121.7	91.3	97.7	106.1	151.5	58.1	61.8*	60.2	70.6	87.7	94.7*	94.2	98.7
Rubber products	75.5	95.6	120.7	98.5	70.7	84.8*	89.7	80.2	.....	.....	.....	.....	73.8	95.7	126.4	108.1
Shipbuilding	79.0	82.5	85.1	85.6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Stone, clay and glass	70.2	77.5*	87.1	105.9	.....	.....	.....	.....	50.8	56.7*	72.7	102.0	89.1	96.7*	109.0	101.5
Textiles	62.4	54.0*	55.2	95.0	50.3	39.5*	42.6	74.8	66.7	64.5*	58.0	123.9	81.5	78.3*	79.3	109.5

*Revision.

Electropneumatic control.
Pneumatically released spring-set brakes.
Six-point acceleration on bucket.
15-ton bridge for steel plant use.

Modern Ore Bridge

By R. W. MONROE
General Engineer
Westinghouse Electric & Manufacturing Company,
East Pittsburgh, Pa.

A LARGE steel plant in the Pittsburgh district has recently placed in operation an ore bridge which contains many innovations in the electrical equipment for increasing the safety of the operator and reliability of the equipment and reducing the maintenance. The bridge is of the man-trolley type with electropneumatic control and pneumatically released, spring-set brakes.

All motors are of the mill type with roller bearings. The bridge and rail clamp motors are totally inclosed and the close, hold and trolley motors are of the inclosed ventilated type with ventilating hoods mounted over the motor openings. These motors are mounted on the man-trolley without any additional inclosure or protection. They are suitable for forced ventilation at a later time if loading conditions increase to such an extent as to require greater thermal capacity of the motors. Forced ventilation will be obtained through the use of individual motor-driven blowers mounted over the motor openings on the rear end of the frames.

The pneumatically released, spring-set brakes are similar in construction to solenoid type brakes except that the solenoid-operating mechanisms have been replaced by pneumatic releasing cylinders. The brakes are controlled by electrically operated solenoid valves, which are duplicates of the solenoid valves used on the pneumatic contactors. One advantage of the pneumatically released brakes is that valves can be installed on the air exhaust lines to permit slowly exhausting the air from the brake cylinders, thereby providing for gradual application of the brake shoes. This feature is particularly desirable on the bridge motor brakes to assure gradual deceleration of the bridge in case of power failure or if the operator quickly returns the master switch from the full speed to the "off" position.

The bridge will be used for feeding four large blast furnaces in addition to stocking ore and any failure of the bridge would prove costly. Thus the additional cost of using this type of control is entirely justified due to its greater reliability for maintaining uninterrupted service. Only two sizes of electropneumatic contactors are used on the entire bridge.

The control is suitable for operation over a voltage range of 130-260 volts and a minimum air pressure of 50 lb. Auxiliary magnetic contactors are of the railway type suitable for operation over the same voltage range as the electropneumatic contactors.

Inductive type, time-limit accelerating relays insure proper acceleration, with absence of complicated mechanical devices to obtain the time delay.

Some of the advantages obtained through the use of electropneumatic type of control are:

1. Great reliability.
2. Faster and smoother operation. Large electropneumatic contactors are from six to ten times faster in operation than the large magnetic contactors of equivalent rating.
3. Unit type contactor construction permits easy replacement when necessary.
4. Satisfactory operation over wider voltage range.
5. Greater arc-rupturing ability.
6. The presence of air near all electrical equipment is conducive to more frequent blowing dust and foreign matter from the equipment.
7. Self-contained, self-supporting steel structures require minimum space and ease of installation and wiring.
8. Large barriers between the electropneumatic contactors eliminate possibility of flashover.
9. Low maintenance, due to rugged construction and oversize parts. Electropneumatic contactors have been used for many years in heavy traction service under the most adverse operating conditions where reliability and long life are of primary importance.

All resistors are of the edge-wound type, the ribbons being made of non-breakable, non-corrosive alloy. Only three sizes of resistor tubes are used on the bridge, thus

Electropneumatic Control a Feature

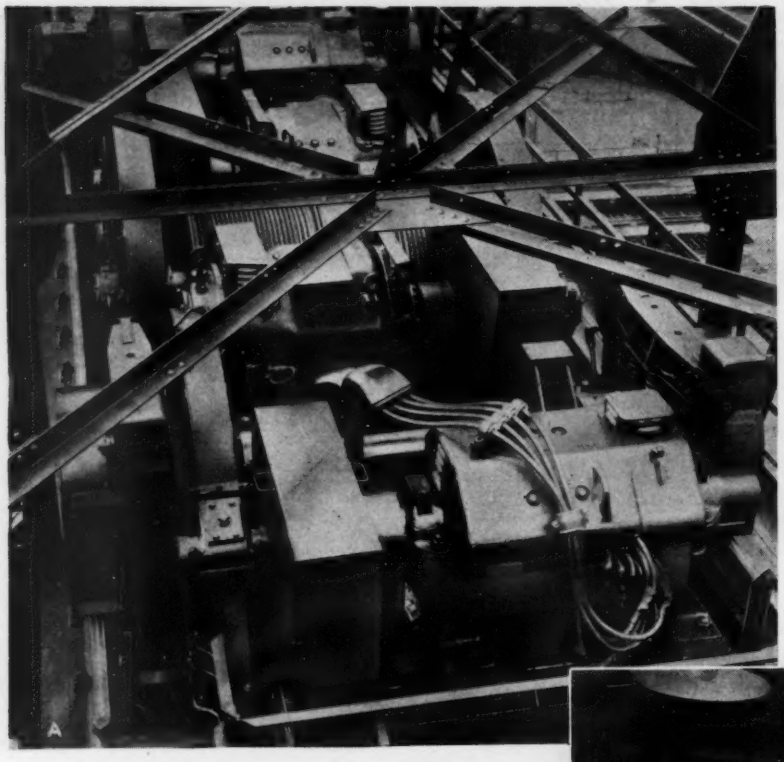
(A) Mill type motors mounted on the man-trolley without any additional inclosure or protection. The brakes are protected by sheet-metal hoods.

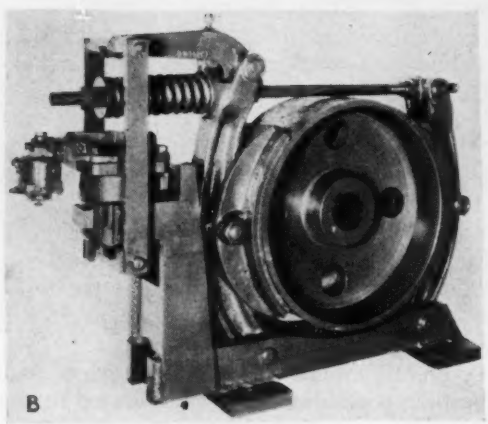
(B) The pneumatically released, spring-set brakes are similar in construction to solenoid type brakes except that the solenoid-operating mechanisms have been replaced by pneumatic releasing cylinders.

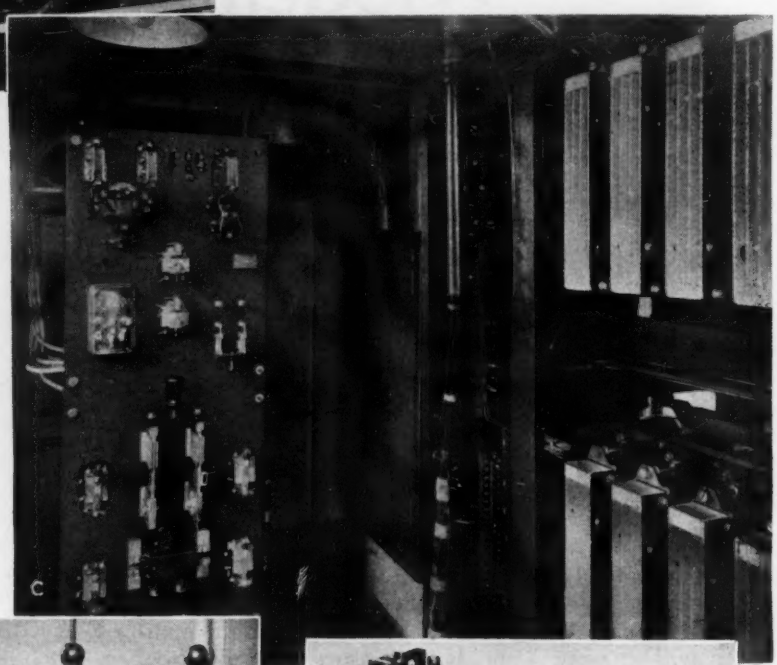
(C) The bucket-hoisting mechanism consists of a close drum and a hold drum driven by individual motors. Each motor is controlled by a master switch with a pneumatic controller. This view of the hoist controller cab shows side of close motor controller and front of hold controller.

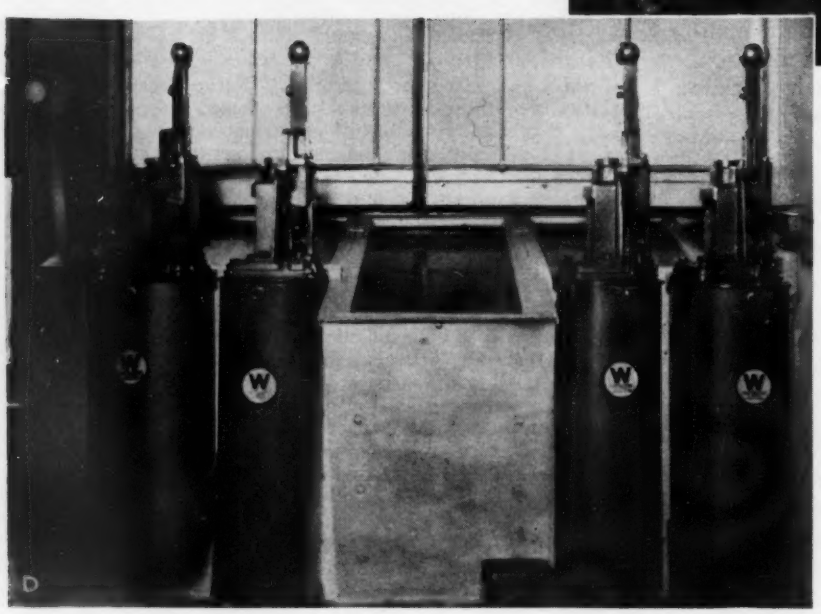
(D) View of operator's cab showing master switches, dead-man safety foot switch and trolley brakes control valve.

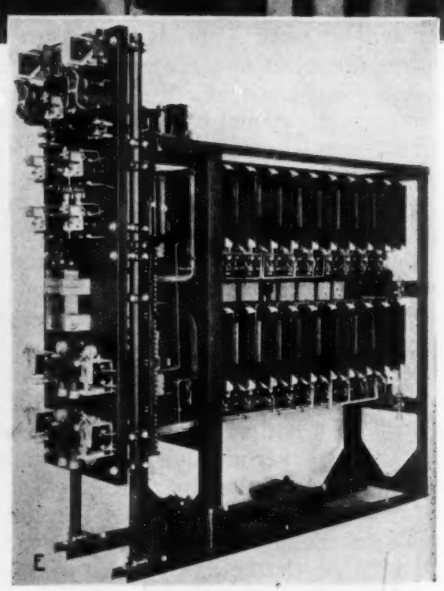
(E) Electropneumatic contactors and auxiliary relays are mounted on steel structures.











keeping the supply of renewal parts down to a minimum. A heavy-duty, inclosed safety disconnect switch is mounted on one of the bridge legs where the power enters the bridge from the collector rail system, thus serving as a disconnect to isolate all electrical equipment on the bridge. Another heavy-duty, inclosed, safety disconnect switch is located in the man-trolley and when opened isolates the hoist and trolley equipment.

Air compressor mounted on man-trolley

An air compressor of approximately 75-cu.ft.-per-minute displacement is mounted on the man-trolley for supplying air to the electropneumatic contactors and brakes on the close, hold and trolley. An air compressor of approximately 25-cu.ft.-per-minute displacement is mounted on each end of the bridge for supplying air to the bridge controller and brakes.

The bucket-hoisting mechanism consists of a close drum and a hold drum, each driven by its individual motor through a single herringbone reduction gear operating in a bath of oil. Each motor is controlled by an individual master switch in conjunction with a pneumatic controller. The control provides six points of acceleration in each direction with inductive time-limit accelerating relays. High-speed lowering of the bucket with graduated dynamic braking under control of the operator is also permitted. In addition operation of the close motor is arranged for kickoff for fast acceleration and high-speed opening of the bucket.

The trolley is driven by two motors geared to their respective pair of trolley wheels through single herringbone reduction gears running in a bath of oil. In normal operation deceleration of the trolley is accomplished by plugging the motors and the brakes will not set in bringing the trolley to rest. A manually operated lever valve is installed in the operator's cab, however, to permit the operator to set the brakes when desired. This valve permits gradual application of the brakes, depending on the rapidity with which the operator opens the valve to exhaust the air from the brake cylinders. The solenoid valves also assure setting of the brakes in case of power failure.

Both trolley motors are controlled by electropneumatic controllers with a single six-point master switch. The accelerating contactors are under control of inductive time-limit accelerating relays to insure smooth acceleration, and plugging relays are used to prevent abnormal peak currents on the electrical equipment and too-rapid deceleration of the trolley.

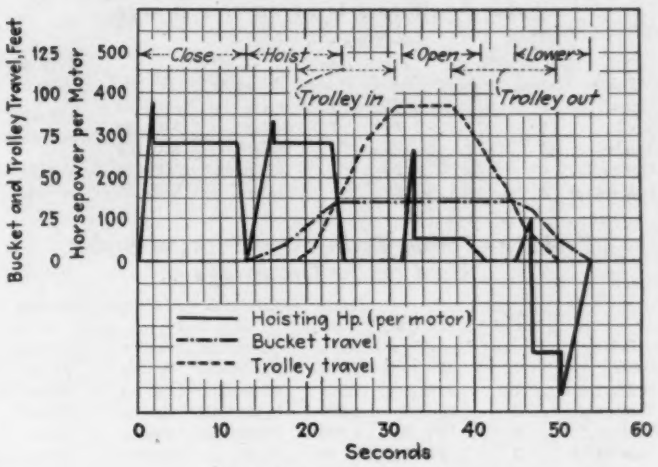
Four track type limit switches are mounted on the man-trolley for obtaining slow-down and final stop protection in both directions of trolley travel. The two slow-down switches are operated by knocker arms mounted along the trolley runway approximately 25 ft. from each end of the runway. The slow-down feature requires the operator to reduce the speed of the trolley to a predetermined value before operation of the slow-down switch under penalty of having the motors de-energized and the trolley brakes set. This feature is accomplished by means of a voltage relay connected across the armature of one of the trolley motors. The contacts of the relay are shunted across the slow-down limit switch contacts and open when the counter-voltage of the armature exceeds a value equivalent to the reduced speed desired. This arrangement insures slow-speed operation of the trolley when it is working near the ends of the runway, thereby providing maximum safety to the bridge equipment and the operator. The two final stop-limit switches are operated by knocker arms mounted along the trolley runway approximately 5 ft. from each end and, when operated, de-energize the motors and set the brakes. The trolley can be backed out of the final limits by moving the master switch to the reverse position.

The bridge is propelled by four motors, two of which are mounted on each end of the bridge and connected to the wheels through speed reducers operating in a bath of oil.

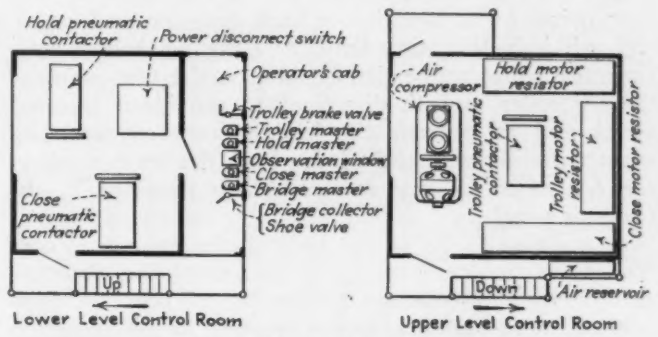
The bridge brakes are equipped with cushion chambers to provide gradual application of the brake shoes, thus preventing too-rapid deceleration of the bridge. An electropneumatic, duplex controller is mounted on each end of the bridge structure for control of the two

General Operating Characteristics of Ore Bridge

Weight of bucket, lb	33,500
Weight of ore, lb	34,000
Bucket hoisting speed, ft. per minute	235
Average hoist distance, ft	35
Trolley free running speed, ft. per minute	800–900
Average trolley travel, ft	90
Maximum trolley travel, ft	255
Bridge free running speed, ft. per minute	140
Bridge span between rails, ft	190
Time of one complete cycle, seconds	54
Power supply, volts d.c.	230



Typical operating cycle



Arrangement of double-deck man-trolley control cab

Table I—Motors Used on Ore Bridge

Drive	No. of Motors	Hp. per Motor	Time — Temp. Rise Deg. C.	Time — Hour	Winding	Fr. No.	Type of Inclosure
Close	1	275	75	1	Series	MC-165	Inclosed ventilated
Hold	1	275	75	1	Series	MC-165	
Trolley	2	170	75	1	Series	MC-100	
Bridge	4	70	75	1	Compound	MC- 70	Totally inclosed
Rail clamp	2	8.5	75	½	Series	MC- 20	

Table II—Torque Ratings and Types of Brakes Used on the Ore Bridge

Drive	No. of Brakes	Brake Wh., Dia.xFace	Cont. Torque, Lb.Ft.	Method of Releasing	Method of Setting	Method of Mounting
Close	1	28 x 11	7,000	Pneumatic	Spring	Floor
Hold	1	28 x 11	7,000	Pneumatic	Spring	Floor
Trolley	2	23 x 9	2,800	Pneumatic	Spring	Floor
Bridge	4	19 x 8	1,800	Pneumatic	Spring	Floor
Rail clamp	2	6 x 2	40	Spring	Solenoid	Motor

motors on that end of the bridge. The control provides four points of acceleration in each direction under control of inductive time-limit accelerating relays. An armature shunt connection is used on the first point of the controller in both directions to provide a creeping speed and to prevent the bridge from overspeeding when traveling with the wind. Both duplex controllers are controlled by one master switch mounted in the operator's cab.

In addition to the bridge control, the rail clamp control is also mounted on the duplex controller structure and interlocked with the former as follows: A foot-operated push-button switch is mounted in the operator's cab in close proximity to the bridge master switch and when depressed energizes the rail clamp motors. When the rail clamps are fully released they actuate limit switches which de-energize the rail clamp motors and energize the spring-released electrically set brakes, thus holding the rail clamps in the released position. Additional contacts in the rail clamp limit switches complete a circuit to the bridge controllers, making it possible to move the bridge as soon as the operator moves the bridge master switch from the "off" position. The foot-operated push button serves as a dead-man feature, inasmuch as it is necessary for the operator to hold the switch depressed at all times that the bridge is to be moved. In case the operator removes his foot from the switch, or in case of power failure, the bridge motors are de-energized and their brakes set and the rail clamp brakes are released, causing the rail clamps to be set by heavy compression springs.

Push-button control for skewing

Two momentary-contact type push-button switches are mounted on the wall near the operator. Each switch is connected in the low-voltage release circuit of one of the duplex controllers and permits the bridge to be skewed within reasonable limits when necessary by de-energizing the motors on one end of the bridge. Automatic skew limit protection is provided by means of two drum type switches. These switches are so connected in the control circuit that during the bridge movement, if the structure gets out of alignment, an armature shunting connection is provided for the motors on the leading end. If this fails to bring the bridge in alignment and the angle of skew increases the motors on the leading end of the bridge are de-energized, but their brakes are held released, thus providing a drift point. If some extraordinary condition exists whereby the angle of skew becomes greater the brakes on the leading end of the bridge are applied, thus bringing that end of the bridge to rest until the bridge is again in alignment.

Additional contacts in the rail clamp limit switches operate a bank of colored lights to indicate to the operator at all times whether the rail clamps are released or set. An anemometer is located on top of the bridge, interlocked with the bridge controllers. If the wind velocity exceeds the value for which the anemometer is set to trip the bridge motors are de-energized, their brakes are applied and the rail clamps set.

The bridge was designed and built by the Dravo Contracting Company. The electrical equipment was furnished by the Westinghouse Electric & Manufacturing Company.

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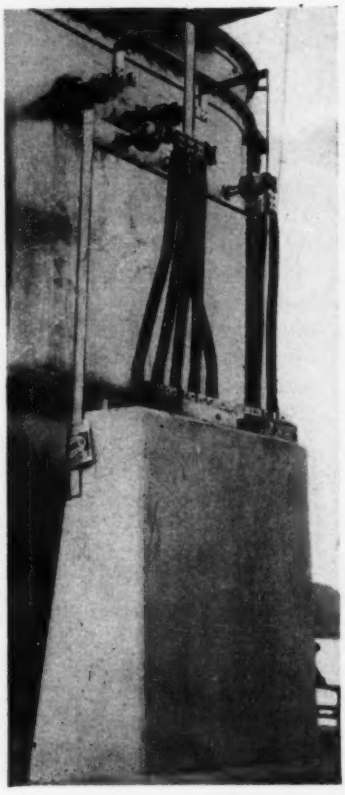
Transformer Connections Allow Expansion and Contraction



Compactness, safety and flexibility in the face of a wide range of outdoor temperature changes feature the design of the primary cable connections of the power transformers at the Fifteen-Mile Falls plant of the New England Power Association system. Each generator is connected by three 1,500,000-circ.mil, 13.8-kv. cables per phase to a corresponding bank of three 13,000-kva. step-up delta-connected single-phase transformers of the non-resonating type.

Between each single-phase transformer and the next unit in the delta the connection is made in each case by two 1,250,000-circ.mil cables. At each single-phase unit the generator cables are brought up to the transformer on the top of the dam through ducts carried through a concrete pedestal as shown, the conductors terminating in a lug supported by two insulators carried on a channel-iron frame well out of reach from the dam deck. Connection to the terminal bushing lug of the transformer is made by three 3x⅛-in. copper bars mounted in two right-angled turns for expansion and contraction reasons. From the first terminal lug mentioned above the connection to the next transformer delta is made by the two right-hand cables shown in the group of five at the left. The other inter-delta connection is brought out of the transformer tank to two cables at the right similarly to the generator connection, with suitable separation.

Research Brings Remarkable New Liquid Insulator

Non-inflammable, non-explosive, high dielectric constant.

By F. M. CLARK
General Electric Company, Pittsfield, Mass.

The use of mineral oil as an insulating and cooling medium in electrical equipment was a step of major importance in the development of the electrical industry. The soundness of this application of mineral oil, which was a bold and radical move, has been justified by a 40 years' service record.

Until recently unremitting research throughout this long period has failed to produce a non-inflammable insulating and cooling medium approaching oil in its suitability for the purpose, and mineral oil will probably remain in general use for years to come for economic reasons. The requirements of an ideal material might be stated as follows:

1. High dielectric strength.
2. Chemical stability under heat and catalytic action—(a) non-oxidizing, (b) non-acid forming.
3. Rapid demulsification.
4. Low freezing point.
5. Low viscosity.
6. Non-inflammability and non-explosive vapors or products of decomposition when mixed with air.

To a high degree, mineral oil meets all of these requirements except that of non-inflammability and non-explosiveness.

As a result of several years' study and development work the research organization of General Electric has put into use, under the trade name "Pyranol," an entirely new synthetic cooling and insulating medium, which has, in addition to the characteristics of mineral oil, the very distinctive property of being non-inflammable and non-explosive.

"Pyranol" is produced in different forms for different purposes, all forms consisting of synthetic organic dielectrics of varying physical and electrical properties, and all having a relatively high dielectric constant. Characteristics of a typical form are as follows :

Color	Water-white
Burning point	None
Viscosity (Saybolt)	40 seconds (37.8 deg. C.)
Pour point (ASTM)	Minus 30 deg. C.
Dielectric constant	5

Dielectric Characteristics—When alternating voltage is applied to a series of insulations of varying dielectric constants the stress is distributed inversely as the constants. The new product has a dielectric strength of the same high order as mineral oil and a dielectric constant (specific inductive capacity) approximately twice that of oil, being practically the equivalent to those of solid insulations. It therefore equalizes the stresses when used in series with solid insulations and eventually may permit material improvements in designs.

While its dielectric characteristics would not prevent its use with existing designs, the fact that it is an active solvent for some of the materials which have been used in electrical apparatus, particularly transformers, makes its use impractical except in apparatus designed and built specially for this new insulating medium.

Chemical Stability—Long-continued tests at temperatures from 75 to 150 deg. C. have shown it to have marked stability and to be itself unaffected by the action of materials in electrical design, thus providing a neutral liquid capable of retaining its initial characteristics through long periods of service. Its marked stability and resistance to oxidation when exposed to high temperatures and air over extended periods has been demonstrated by extensive tests. There is no sludging after continued application of heat and exposure to the air.

Demulsifying Effect—Insulating liquids are readily raised to a high dielectric strength by filtration or other means. However, the maintenance of this dielectric strength in service depends upon continued freedom from contamination with water or from suspended solid particles obtained by contact of the insulating liquid with the solid insulations. Contamination by moisture is perhaps the most troublesome. Therefore, a liquid dielectric should be able to demulsify rapidly. Also, it is desirable that the moisture on demulsification should come to the surface of the insulating liquid so that it can be eliminated by evaporation. In addition the liquid should have little, if any, solvent action on water.

"Pyranol" has these highly desirable demulsification characteristics: It demulsifies more than twice as fast as mineral oil. It is heavier than water. Therefore, the moisture on separation rises to the surface, as contrasted with moisture in mineral oils, which, on demulsification, settles at the bottom of the oil. Its water solubility is too small to have been thus far accurately measurable. Pyranols in contact with air and allowed to breathe freely have maintained consistently high values of dielectric strength, even when exposed for periods of three months or more.

Freezing Point and Viscosity—The viscosity as well as the freezing point can be closely controlled and the desired values obtained without the sacrifice of other qualities.

Flameproof and Explosion-Proof—Any organic dielectric when subjected to an electric arc breaks down and gases are evolved. Mineral oil under an electric arc develops hydrogen, together with volatile saturated and unsaturated hydrocarbons. The relative volume of each gas depends on the conditions of the arc, the type of oil and other factors. In general, however, the gases evolved from oil are composed of hydrogen 50 to 60 per cent, unsaturated hydrocarbons 25 to 30 per cent and saturated hydrocarbons 6 to 10 per cent. These gases form explosive mixtures with air.

If "Pyranol" is subjected to an electric arc, the gases evolved are non-explosive in all proportions in an air mixture. No hydrogen is present and only traces of saturated and unsaturated hydrocarbon gases can be observed. The gases consist mainly of hydrogen chloride, which can readily be disposed of by an absorption device connected to the transformer through a breakable diaphragm, or conducted by suitable piping to the open air for dissipation. This gas is not an active poison, though irritating. Its presence even in small quantities is evidenced by a characteristic and immediately noticeable odor.

Application—Commercial applications of the new material during the past two years in capacitors and transformers show that with its use the physical size of the former, per microfarad, can be made much smaller and the reliability increased.

In transformers it has been limited to installations where fire and explosion hazards are to be completely eliminated, justifying the higher cost of Pyranol transformers as contrasted with oil-immersed transformers.

The developing of a material of such new and important properties opens a wide field of possible applications which has not yet been fully investigated.

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Dutch Highway Lighted with Single-Color Sources

Monochromatic light is being used in an experimental installation of highway lighting on a 1-mile stretch of main route in Holland between the towns of Maastricht and Nijmegen. The lamp used is a new form of the gaseous discharge type developed in the Philips Glowlamp Works at Eindhoven by Dr. Gilles Holst and his staff. The pure yellow color of the light is claimed to have high effectiveness because it provides only light-dark contrasts and thus capitalizes on the lack of color sensitiveness of the eye under the low highway intensities used even in this relatively high-intensity installation. Visual acuity is enhanced about 100 per cent by confinement to the monochromatic bands of sodium light.

In view of the difficulties in comparing monochromatic light intensities and their effectiveness with incandescent sources that are mixtures like sunlight the manner of locating the lighting units made no attempt to follow usual practices in highway lighting installations. In fact, highway lighting varies so much in candlepower, height and spacing of units, reliance on reflectors, etc., that it would be difficult to imitate any accepted convention. Therefore the layout is in itself a departure calculated to derive the most from the light sources used.

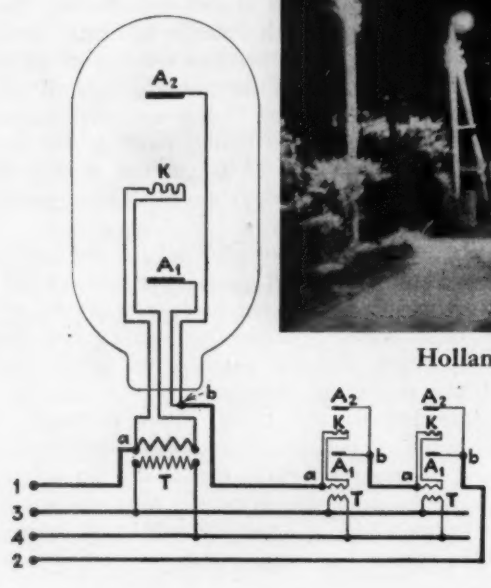
The units are disposed in zigzag asymmetrically and an asymmetrical reflector is also used. A unit on the right-hand side is placed at less than half the distance between the two on the left-hand side. Its beam is directed obliquely toward the one ahead on the left and vice versa. The beam centers are thus directed obliquely ahead of the traffic on each side of the highway. As a result of this and the distribution characteristics of the reflectors used the irregularity factor has been cut to the very low value of 6. On the 40-ft. highway the lamps on alternate sides come at intervals of approximately 60 and 115 ft. Along the center line of the road the intensity with 5,000-lumen sources ranges from 8 to 2 lux and in the middle of each lane from 13 to 2 lux, a six-to-one range. Irregularity factors of 40 or higher are not uncommon in highway lighting.

The lamp has a bulb diameter of 6 cm. and a length of about 12 cm. In order to maintain the temperature within the range 200 to 300 deg. C. as required for establishing the requisite sodium vapor pressure the emission bulb is inclosed in a second glass container and the intervening space evacuated. A rare gas filling and a small quantity of metallic sodium are in the luminous source. When the cathode filament is heated the rare gas glows and shortly the temperature rises to the point where the sodium vapor dominates the luminous energy emission almost entirely. The light is practically monochromatic, therefore.

In this experimental installation a four-wire circuit is provided so that several schemes of arc and filament supply can be tried out. In one set-up the filament current is a.c. provided by transformation to low voltage from a higher voltage supplied by two of the wires. The 12-volt, 5-amp. arc current is supplied by the other two wires with the lamps in series arrangement.

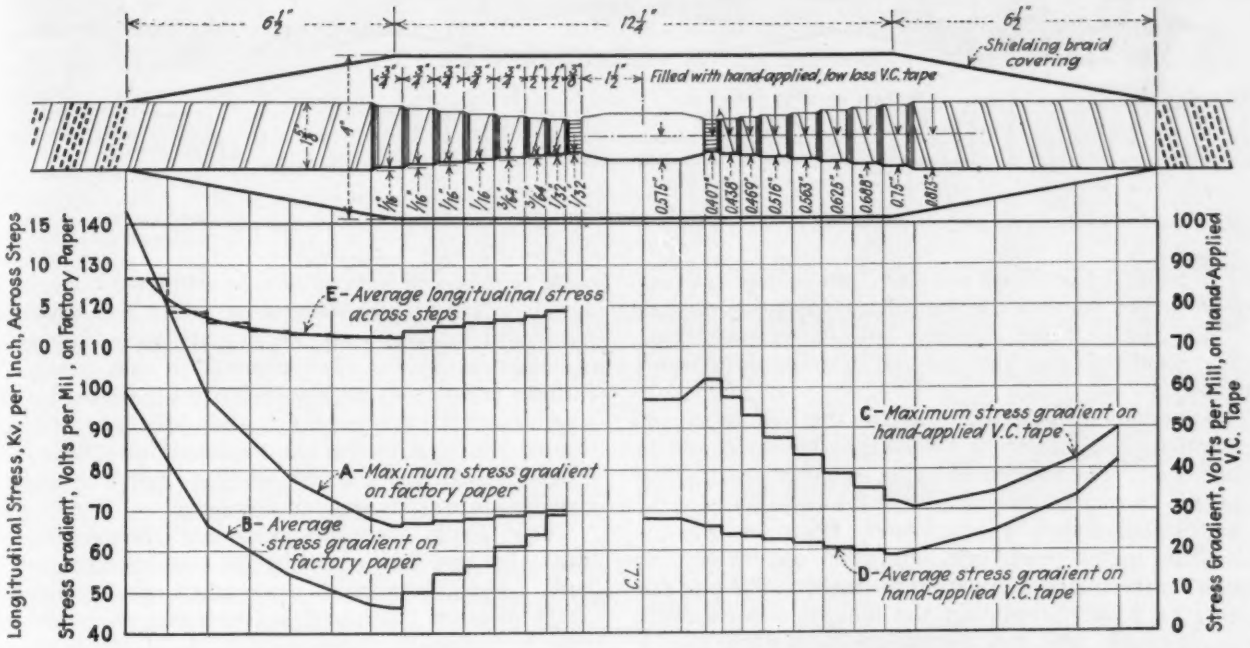
These lamps consume about 100 watts each and produce a luminous flux of between 5,000 and 6,000 lumens with a surface brightness of 7 candles per square centimeter, a value favorable to the reduction of glare. On the whole the improvement of 100 per cent in visual acuity and the reduction to one-third in energy consumption in the sodium lamp offer the chance to increase by six times the effectiveness and economy of lighting traffic ways in comparison with incandescent filament sources.

Double anode used in monochromatic sources for highway illumination



Holland highway lighted by sodium lamps

Voltage Stresses in Cable Joints


6½"
12¼"
6½"
Shielding braid covering
Filled with hand-applied, low loss V.C. tape
E-Average longitudinal stress across steps
A-Maximum stress gradient on factory paper
B-Average stress gradient on factory paper
C-Maximum stress gradient on hand-applied V.C. tape
D-Average stress gradient on hand-applied V.C. tape
C.L.
Longitudinal Stress, Kv. per Inch, Across Steps
Stress Gradient, Volts per Mil, on Factory Paper
Stress Gradient, Volts per Mil, on Hand-Applied V.C. Tape

Stress distribution in 69-kv. joint. The sketch at top represents one conductor of the three in the joint. The ordinates of the curves are the longitudinal dimensions of the joint.

By E. F. NUEZEL

Columbia Engineering & Management Corporation, Cincinnati, Ohio

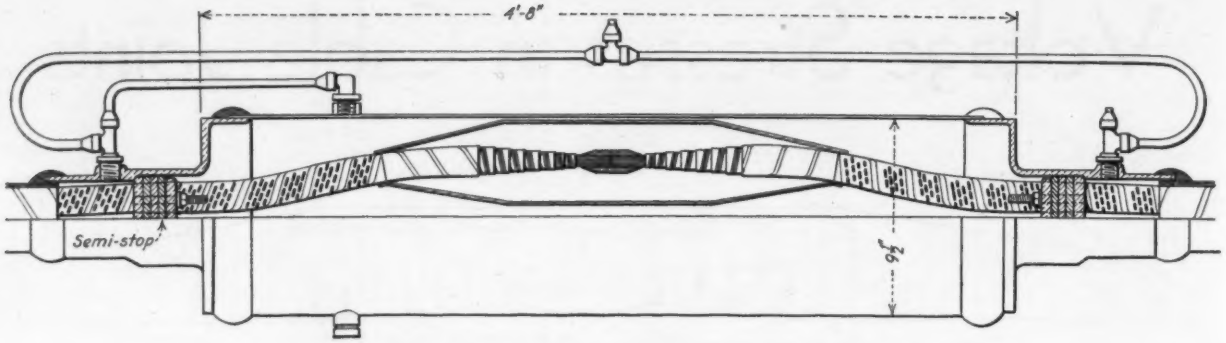
IF JOINT failures were stated on a mileage basis it would be shown that failures occurred in joints with more than 60 times the frequency of their occurrence in cables. The 1931 report of the N.E.L.A. subcommittee on cable operation shows that there were 3.62 failures per thousand joints per year on cables of 15.1 to 35 kv. and 1.64 failures on cables above 35 kv. Assuming an average joint length of 3 ft. for the 15.1 to 35 kv. and 5 ft. for the joints above 35 kv., the failures per hundred miles of joint per year would be 637 and 173 respectively, or 405 including both voltage ranges. Dividing this by the latest 1931 figure of 6.6 failures per hundred miles of cable results in a ratio of 61 to 1 between joint and cable failures when they are expressed on the same unit basis. This does not indicate that the ideal, that a cable joint should be at least as strong as the cable lengths it joins, has been attained.

It is reasonable to expect this because cable is fabricated and impregnated by machine in the factory under very carefully controlled conditions of humidity and tension with carefully selected and graded materials having predetermined electrical and physical properties. Joints, on the other hand, are generally hand-made, and even though made under ideal conditions are subject to the human element, which is an indeterminate factor. It is estimated that at least 23 per cent of all joint failures are due to inferior workmanship.

The importance of joint design, at least for voltages above 15 kv., is at once apparent in view of the above hazards and operating records. It is significant to note that there were more than twice as many joint failures last year on joints of 15 to 35 kv. than there were on joints above 35 kv. This indicates conclusively that more care must be given to design and construction in this class. In the higher voltage class (above 35 kv.) the average operating company has fully appreciated the importance of design and has accepted the manufacturers' recommendations. The distribution of the joint materials must be such that the limiting gradients for each of the composite insulations are not exceeded, especially the hand-applied tape.

As an example of a well-engineered joint, here is an analysis of stress distribution in the three-conductor, 69-kv., type "H," 500,000-circ.mil sector, oil-filled, shielded-type cable joints of the Union Gas & Electric Company. It is not the purpose of this discussion to enumerate the commonly known errors that would cause trouble in a joint, but rather to show approximately what stresses obtain in the normal joint as shown in the drawing.

It will be noted on curve *A* that the maximum stress gradient of 143 volts per mil on the mill insulation occurs at the surface of the conductor at the end of the factory applied ground shield and decreases as the stepping is approached to a value of about 70 volts per mil at the conductor under the first step. The materially higher value at the ground shield and along the slope is permissible because it is occurring on the undisturbed mill insulation. If we compare curve *C*, which shows the maximum stress gradient on hand-applied varnished cambric, we will note that a maximum stress gradient of 62 volts per mil occurs at the surface of the con-



69-kv. joint for which potential stresses are analyzed

ductor. This value of 62 volts per mil is only approximately 44 per cent of the maximum value imposed on the mill insulation and indicates how the inferior hand-applied insulation has been favored in order to minimize hazards.

The average stress gradient across the mill paper and the hand-applied insulation is shown by curves *B* and *D*, respectively. The maximum value of the average stress across the factory insulation (curve *B*) still occurs at the ground shield and is approximately 98 volts per mil. This value might seem high, but when considering the stresses on the factory insulation throughout this analysis it must be remembered that the dielectric is oil-filled, under pressure, and will permit approximately double the values of stress that would be permitted on solid type cable insulation.

It would not be safe to work the hand-applied insulation on an oil-filled joint appreciably higher than on a solid type joint because of the hazards of contamination in the hand wrappings and because the joint insulation is not oil-filled to the same degree as the factory insulation. It will be noted in curve *D* that the average stress on the hand-applied insulation is only about 40 per cent of the average stresses existing on the mill insulation.

In cable joints there is another kind of stress known as longitudinal, which exists at all surfaces where the composite dielectrics of different specific inductive capacity join; for example, along the surfaces of the stepping and the factory insulation. This stress is called longitudinal or axial because it tends to creep along the surfaces in a direction parallel to the axis of the cable. It is well known that the dielectric strength of a laminated structure is very much less along the laminations than it is transverse to the laminations, therefore longitudinal stresses are always favored at the expense of both the magnitude and distribution of the radial stresses.

Curve *E* shows the variations of longitudinal stress in kilovolts per inch across the joint. It will be noted that the stress across the stepping is lower than along the slope where the mill insulation has not been disturbed. The average value of longitudinal stress is less than 5 kv. per inch, while the average value of maximum radial stress on the mill insulation is about 68 volts per mil. This is a ratio of less than 1 to 10, which seems to be common practice.

The importance of the proper distribution of stress so that each of the component dielectrics assumes its proper share of the stress without exceeding the safe limiting gradients is being recognized now, especially in the high-voltage class, and it is being realized that joints must be designed instead of just estimated. Every joint design is a compromise between radial and longitudinal stress distribution, with due respect given to simplicity of construction for the splicer. It would have been entirely possible to improve upon the uniformity of the longitudinal stresses (curve *E*) by changing the distribution of the tape in the hand-applied slope between the ground shield and the seventh step, but a straight line distribution was chosen for simplicity.

These joints were designed and their construction supervised and guaranteed by the General Electric Company. The construction work was done by the Union Gas & Electric Company in Cincinnati, in collaboration with the Columbia Engineering & Management Corporation. They have been successfully operating since August, 1931.

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Farm Use Averages Three Times Domestic

Farm and rural customers use a great deal more electrical energy, proportionately, than domestic customers. Reports from 23 companies, with an aggregate of 90,341 such customers, give an average of 1,603 kw.-hr. This is about three times the average residential use in the country as a whole. The sample, for it can only be regarded as a sample, is too small to justify the determining of an exact ratio, but it does justify the general statement that the average farm customer uses considerable energy for power purposes.

In supplying the data published in the supplement to the ELECTRICAL WORLD of May 7 the 24 companies here listed (in the order of their appearance in Table II) added definite information regarding the number of farm or rural customers and the energy sold to them during 1931. Some used the former term, some the latter. While the two are not identical, it seemed permissible for the present purpose to combine them so as to get some measure of energy needs for non-urban customers. Because of probable differences in classification the figures should not be used for comparing individual companies with one another.

Also, it is not to be inferred that these are the only farm or rural customers served by the 142 companies listed in the supplement. According to recent statistics of the National Electric Light Association there were about 700,000 electrically served farms in the United

Farm and Rural Customers Separately Reported

In May 7, 1932, Supplement

Company	Kw.-Hr.	Customers	Kw.-Hr./ Customer
Jersey Central Power & Light Company	5,381,607	8,264	652
Illinois Power & Light Corporation (Illinois)	3,101,136	3,506	885
Central Illinois Public Service Company	4,856,926	6,944	700
Wisconsin Power & Light Company	6,469,251	9,033	716
Nebraska Power Company	1,415,703	1,095	1,290
Des Moines Electric Light Company	1,075,241	1,396	770
Sioux City Gas & Electric Co., Iowa Public Service Co. System	5,387,964	4,835	1,113
Kansas Power & Light Company	820,679	795	1,032
Iowa Railway & Light Corporation	1,904,123	2,441	778
United Power & Light Corporation (of Kansas)	1,049,602	902	1,165
Virginia Electric & Power Company	2,648,883	1,949	1,360
Florida Power & Light Company	2,676,494	1,129	2,370
Birmingham Electric Company	195,350	40	4,880
Kentucky Utilities Company	1,671,806	3,738	447
Texas Power & Light Company	2,180,566	1,355	1,610
Arkansas Power & Light Company	938,552	919	1,022
Gulf States Utilities Company*	12,933,664	374	34,600
West Texas Utilities Company	1,186,371	1,026	1,058
Public Service Company of Oklahoma	412,542	804	513
El Paso Electric Company (and affiliates)	1,271,692	742	1,715
The Montana Power Company	2,892,782	1,788	1,618
Idaho Power Company	21,682,004	8,721	2,490
Puget Sound Power & Light Company	39,339,141	24,061	1,635
The Washington Water Power Company	36,077,501	4,858	7,430
Total*	144,635,916*	90,341*	1,603*

* Gulf States Utilities Company not included in total.

States at the end of 1931. By far the larger part of these received their energy from one of these 142 systems, but separate figures cannot be given because they were included with domestic customers.

There are no conspicuous geographical differences, except that the Western figures are generally higher than the others. This is in line with the larger domestic use together with irrigation in that part of the country.

In deducing the average for the group one company was omitted because it evidently has some extraordinarily heavy consumers. For the others the individual averages vary from 447 kw.-hr. per customer, which is well within the range for domestic users, to 7,430 kw.-hr.

From these data a rough estimate can be made of the amount of electrical energy used annually on farms. Deducting also the large consumption in the State of Washington we arrive at an average of 1,270 kw.-hr. per customer, which may be tentatively taken as typical for the country as a whole.

On that assumption the total for all farm customers, as of the end of 1931, is about 890,000,000 kw.-hr. annually.

According to the latest census there are about 6,300,000 farms. Not all of these are within reach of central-station service. Nor is it probable that they are potentially as large consumers as those already served. On the other hand, the uses of electrical energy are likely to expand. The two considerations therefore tend to balance.

There is thus in sight, though not in the immediate future, an agricultural load of some 8,000,000,000 kw.-hr., which is about two-thirds as large as the present residential load, and of which less than 1,000,000,000 kw.-hr. has thus far been developed.

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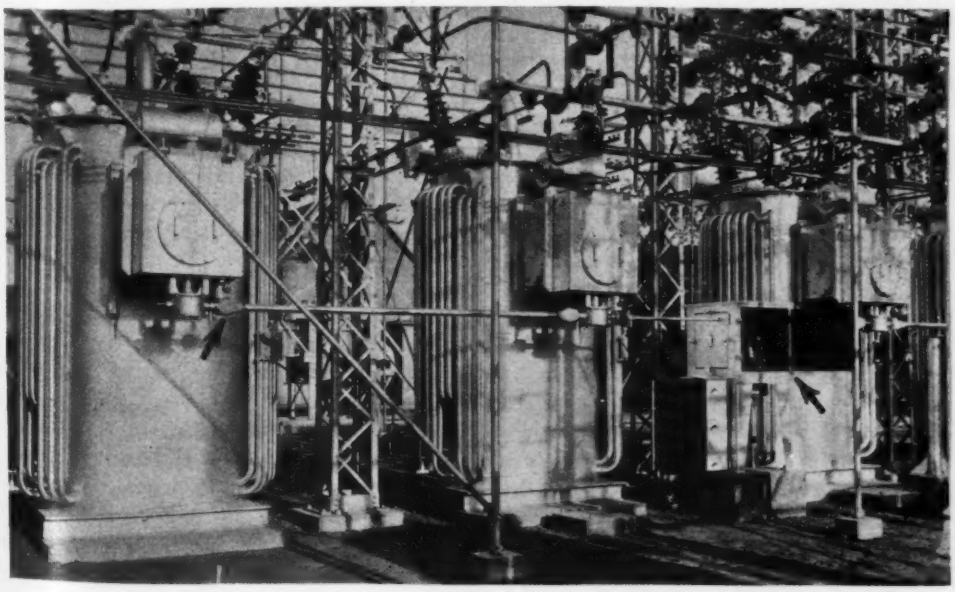
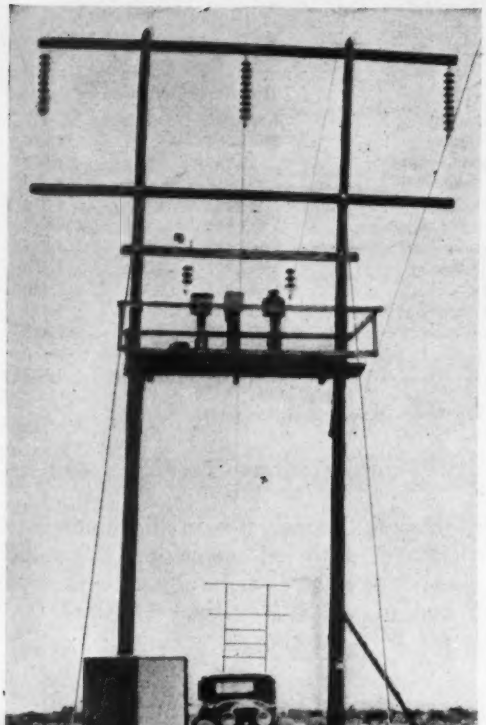
Group Drive for Load-Ratio Adjusters

At the Lodi substation of the Pacific Gas & Electric Company, four transformers equipped with a new design of load-ratio control equipment have been installed recently. This transformer bank, among the first in the country to be thus equipped, consists of four units, one acting as a spare, each rated 1,500 kva., 34,615/60,000 volts—7,200/12,450 volts with a 2,520-volt tertiary winding. Taps providing a 10 per cent buck or boost of the 7,200-volt winding are brought out to load ratio contacts.

The load ratio control, a new development of the General Electric Company, is designated as type LR-12, differing from previous designs in that all units are operated by an automatically controlled group drive mechanism. The driving unit, shown in the center of the accompanying illustration, operates control units of each transformer through a line shaft. Eliminating the individual drive previously used on each transformer, this design is said to save weight and reduce the first cost of a load-ratio control installation.



Part of transformer bank equipped with automatically controlled group drive for load-ratio adjusters



Test station on Idaho Power Company transmission line

Vibration Studies Made With Oscillograph

Film records of vibration, wind direction, wind velocity and time permit accurate analysis of conditions causing this phenomena.

Oscillographic record automatically started by means of a vacuum tube voltmeter.

By C. O. CRANE*

Electrical Engineer Idaho Power Company

VIBRATION as a contributing cause of transmission line failures has been the subject of much investigation in recent years. When it occurs the span breaks up into vibrating sections with stationary points or nodes between the sections. The length between the nodes is a loop, the amplitude of which is the total vertical motion of its center point above and below normal. Maximum amplitude rarely exceeds the diameter of the conductor and is ordinarily less.

It is the generally accepted theory that vibration is caused by a steady low velocity wind blowing transversely to the line. Such a wind causes an air flow in the wake of the conductor, which sets up a system of eddies oscillating backward and forward across the wind behind the conductor.

These eddies result in an alternating force transverse to the wind, which tends to start and maintain vibration. When the period of these eddies coincides with the natural period, or a harmonic, of the elastic conductor, a resonant condition exists, and the motion builds up until balanced by internal and external damping influences. The theory of eddy frequency was first developed by E. F. Relf and E. Ower in 1921 and covered by a report to the British Aeronautical Research Committee on the vibration of airplane stays.

The formula developed by Relf and Ower for eddy frequency is:

$$f = \frac{V}{D} \text{ function of } \frac{VD}{e}$$

where

f = Frequency in cycles per second.
V = Velocity of the medium with respect to the cylindrical wire.
D = Diameter of wire.
e = Coefficient depending upon the medium, being 0.000159 for air.

Theodore Varney of the Aluminum Company applied this formula to conductor vibration and, after further investigation, derived a value of 0.185 for function of $\frac{VD}{e}$ for usual transmission line conductors.

Vibration waves in a suspended cable can be of two forms, standing and traveling. Standing waves have the form of a regular sinusoidal wave with stationary node points. The most prevalent is the traveling type, which has periodic beats that cause a shifting of the node points as the waves travel along the cable. These beats or traveling waves may be caused by the influence of the elasticity of the supports, the vibration in an adjacent span or the eddy frequency of the wind being slightly out of step with the natural period of the span.

The loop length and amplitude vary with the wind velocity. As the velocity decreases, the loop length and amplitude increase and the frequency slows down. Large amplitudes that can be seen from the ground are caused by slow velocities. Large diameter cables may vibrate in winds of as high a velocity as 25 miles per hour, but generally all visible motion ceases before such high velocity is reached. The direction of the wind does not have to be at 90 deg. to the line, and vibration may be set up with an angle as low as 15 deg.

Where the nature of the country is such that the wind can blow uniformly across the line resonant vibration is likely to appear. If the country is broken up by hills, woods and streams the steady drift of the air is interfered with and vibration is not prevalent.

Failure from vibration first occurred at a dead-end clamp on the Thousand Springs-Caldwell-Ontario line of the Idaho Power Company in the spring of 1928. Inspection of this line then revealed that strands of the A.C.S.R. No. 2/0 equivalent conductors had parted in

**Abstracted from the author's paper presented at the Northwest Electric Light and Power Association, Engineering Section meeting, Portland, Ore.*

other places. Repairs were made and armor rods were installed, requiring the replacement of all suspension clamps.

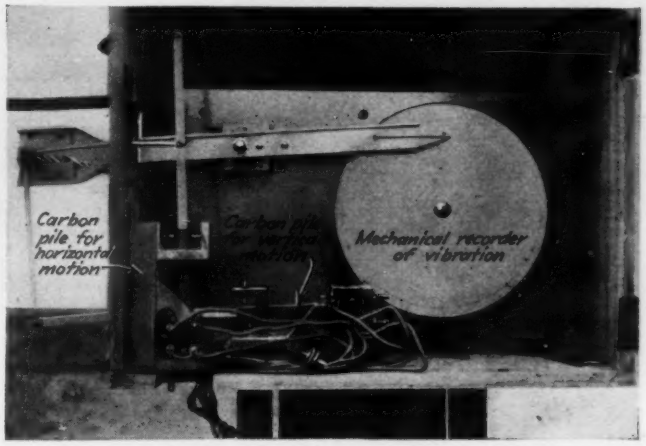
A subsequent inspection of the line in 1931 revealed several apparently new breaks, but investigation showed that the distance from the old breaks to the new was approximately the length of the clamping shoe of the old clamps. This led to the conclusion that breaks found were probably not reported at the time of the repair job or that they had been started before the rods were installed.

Immediately after the last inspection it was decided to study the vibration characteristics of this line. A test span was built on the structures of the line where the largest number of breaks were found in 1928. Two conductors were strung and mechanical recorders were put on each conductor to record the vibration.

The mechanical recorders have a 24-hour waxed chart, and while they record very accurately the presence of vibration, they do not give a record suitable for determining frequency. In making this study of vibration it became apparent that an accurate knowledge of wave form and frequency was necessary to a comprehensive understanding of the action taking place. Therefore, thought was given to developing some device which would give an accurate record of these. A special adaptation of an oscillograph seemed to offer the best possibilities in photographing the actual wave form and frequency. The method used in connecting the oscillograph to the conductor was by means of a twin variable carbon pile resistor. The motion of the conductor is transmitted to the carbon pile through short lever arms made of aluminum. The lever arms were kept as short and as light as possible, to reduce the inertia of the moving parts.

The oscillograph is arranged to record the vibrations in two conductors, wind velocity, the angle the wind makes with the line at the time the film is made and a time scale.

Automatic starting of the oscillograph when vibration occurs is accomplished by means of a vacuum tube voltmeter circuit. Alternating current produced in a three-to-one audio-transformer by the vibrations is amplified by a No. 30 type tube. A very sensitive relay in the plate circuit of the vacuum tube controls a relay that closes the starting circuit to the oscillograph. Adjustment of the relay in the plate circuit of the tube is made by the bias potentiometer in the filament circuit of the tube. As soon as the oscillograph is started a telephone latching relay is energized from the lamp circuit of the oscillograph, which opens the starting circuit of the automatic equipment.



Close-up of mechanical recorder of the conductor vibration

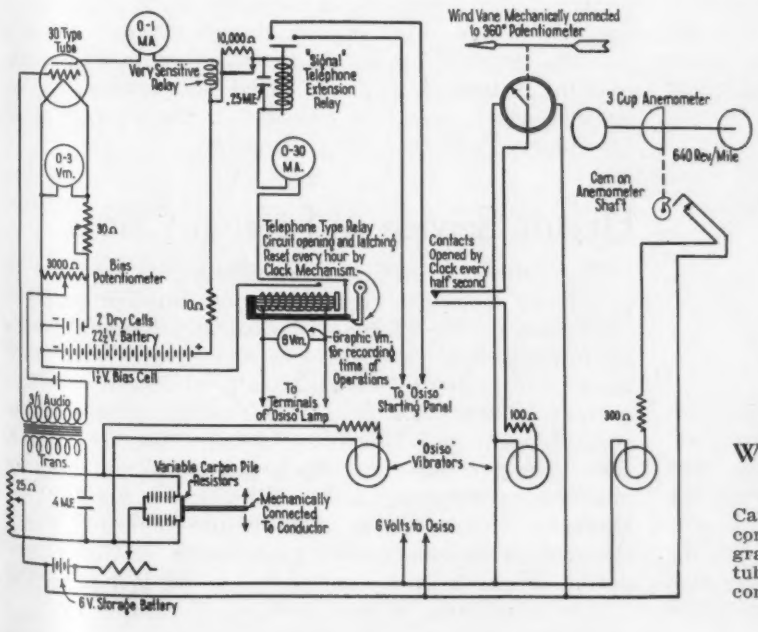
with the carbon pile resistors necessary to transfer horizontal and vertical motion into impulses for oscillograph circuits.

The circuit from the oscillograph lamp also operates a graphic voltmeter which registers the time of the operation of the oscillograph. A thermal relay in the oscillograph stops the operation after a predetermined amount of film has run.

The telephone latching relay is reset every hour by a cam on a clock mechanism. The clock mechanism is also arranged with contacts operated by the escapement so that there is a record of time on the film of one-half second intervals.

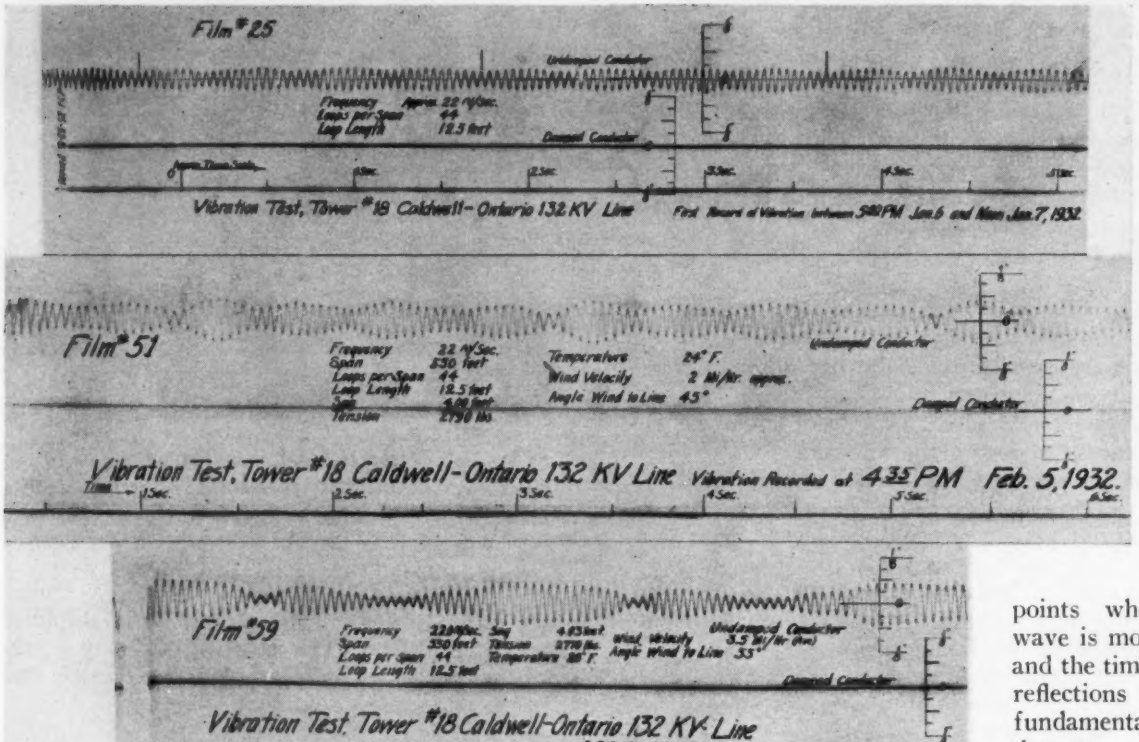
The record of the angle that the wind makes with the line at the time the film is made is obtained from the same vibrator in the oscillograph that records the time scale. This is accomplished by means of a wind vane operating a potentiometer in series with the timing contacts. A displacement of the time record from the zero line is obtained by this arrangement. Calibration of this displacement is made on the viewing screen for different angles and then transferred to the film.

Wind velocity is recorded on the film by means of contacts on the driveshaft of a three-cup anemometer that opens a vibrator circuit in the oscillograph every revolution. One revolution of the shaft registers 1/640 of a mile.



Wiring diagram of oscillograph installation for conductor vibration study

Carbon pile resistors mechanically connected to the conductor vary input to the vibrator of the oscillograph when conductor vibration occurs. Vacuum-tube voltmeter starts mechanism when the latter condition originates.



Oscillographic records taken from the line

Films Nos. 25 and 51 show four beats in the fundamental time period, while film No. 59 shows two beats in the fundamental period. The damped conductor under same atmospheric conditions appears to be unaffected as shown by the straight line in the center of the record.

The carbon resistors are connected to the conductor 29 in. from the suspension clamp and, therefore, do not record the maximum amplitude of the vibrations. The scale for the amplitude is first calibrated on the viewing screen and then transferred to the film.

In analyzing the oscillograph records it is necessary to know not only the frequency, wind and temperature conditions but also the loop lengths. As vibration occurs for the most part at night, when an observer is not present—and, if he were, it would be a rather difficult task to determine the node points—another method other than direct measurement was necessary.

If a wire suspended between two supports is struck a blow at one of the supports a wave will travel along the wire to the other support, be reflected and return to the starting point. The velocity of the wave traveling along the wire is:

$$V = \sqrt{\frac{P}{M}} = \sqrt{\frac{Pg}{W}}$$

when:

V = Velocity in feet per second.
P = Total tension in the wire.
M = Mass per foot of wire.
W = Weight per foot of wire in pounds.
g = Acceleration due to gravity.

The time required for a wave to travel twice the length of the span is the fundamental time period of the span.

From studies of the oscillograph records it has been determined that there is a definite relation between the fundamental time period of the span and the loop length. On records having beats there is a recurrence of the form of the wave at regular time periods. Reflection points can be found that are analogous to the reflection points when a traveling wave is moving in the span and the time period of these reflections checks with the fundamental time period of the span. The loop length can be computed by taking one-half of the length obtained by dividing twice the span length by the number of cycles counted in the fundamental time period. This method has been checked by actual measurement of loop lengths in the field.

It has been suggested that there may be vibration of extremely high frequency superimposed on the lower frequencies set up in conductors by the eddy frequencies of the wind. If this were true the problem of damping out vibrations would become very complicated. Records obtained by the oscillograph show frequencies of from 8.4 to 43 cycles per second without any superimposed frequencies on the main vibration.

Summing up the results of the work done so far, the oscillograph records give a complete story of vibration and can be used in determining the efficiency of damping devices. A complete set of records over a wide range of wind velocities, angle of wind and tension can be secured which would be valuable in the general study of vibration and the design dampers.

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Electric Service in Foreign Cities

From time to time circulars giving data on the type of electric service in cities in various foreign countries are issued by the Electric Equipment Division, Bureau of Foreign and Domestic Commerce, of the Department of Commerce. Each usually relates to a single country or to a small group more or less closely related geographically or politically. An index list, covering 30 such circulars, has now been published and may be obtained by applying to the Bureau of Foreign and Domestic Commerce at Washington. Formerly the circulars were distributed gratuitously. Under provisions of the economy act passed at the last session of Congress a charge is now made of 20 cents a copy.

"Spot" Networks Installed in Chicago Region

By C. C. VAN DENBURGH*
Public Service Company of Northern Illinois, Chicago

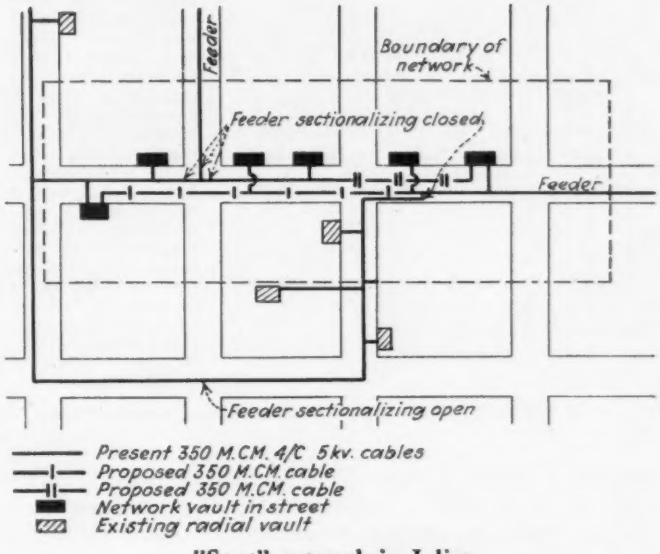
CROWDED vaults and overloaded transformers and secondary cables, in the one case, and accession of a large load, in the other, caused the Public Service Company of Northern Illinois in the past year to establish secondary network nuclei in Joliet and Oak Park, suburbs of Chicago. To provide for normal increases of load and future development in the Joliet main business section, which has a connected load of approximately 4,500 kva., with a maximum demand of about 3,500 kva., in an area of one-tenth square mile, it would have been necessary to rebuild most of the vaults, replace the transformers and install new secondary cable if the existing radial system of distribution were continued. This work would have involved the expenditure of considerable money and in the end would not have provided the class of service required.

From a study of four variations of the radial system and two network designs it was concluded that for the ultimate layout the network fed at 2,300/4,000 volts from existing radial feeders was the most economical. However, immediate installation of a complete network was not justified and it was decided to install a small "spot" network in the area of highest load concentration. As load growth required this network would be extended.

In order to operate a spot network successfully it is essential that capacity be provided to burn off any secondary faults that may occur. Because of the short length of the two primary feeders in this installation it was possible to obtain this capacity by adjusting the feeder overload relays at the substation. With this arrangement all secondary faults, except faults occurring on the bus or leads to the bus from the protectors, will burn clear. Solid faults on the bus or in these leads will probably interrupt service on the grid. However, because of the type of bus cable used, its location and method of support, the possibility of such fault is very remote.

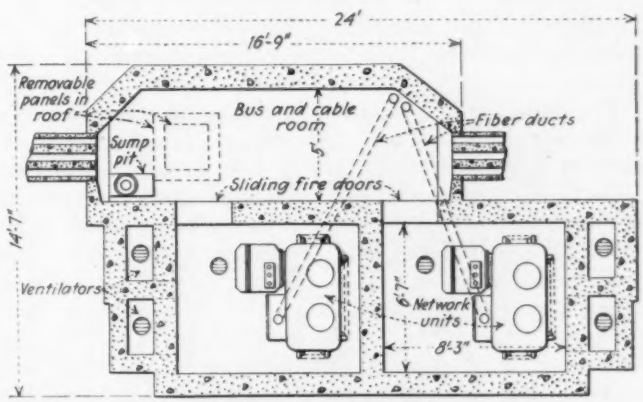
Since the network parallels the two feeders through the secondary grid unequal primary voltages would have resulted in a transfer of load from one feeder to the other. Such a load transfer would cause the ordinary network protector to open automatically on back feed. As the feeders are very short and of approximately the same length, the difference in voltage between feeders caused by line drop under full load conditions is small —around 2 per cent. It was felt that satisfactory volt-

Adapted from paper to underground systems committee, Great Lakes Division, N.E.L.A.



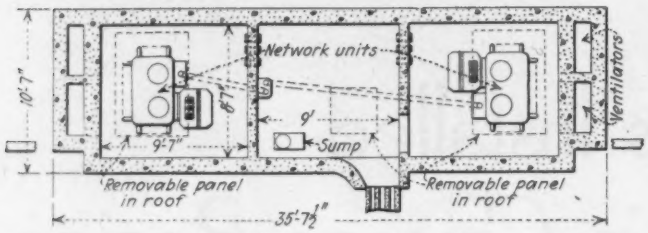
"Spot" network in Joliet

Two 300-kva., three-phase transformers are installed in the two end vaults and one in each of the intermediate. Two existing feeders are used (350,000-circ.mil, four-conductor, 5-kv. cable). In order to provide satisfactory secondary grid voltage and burn-off capacity with one feeder out of service taps are made so that no two adjacent transformers are connected to the same feeder. The secondary grid consists of two 250,000-circ.mil. single-conductor, 600-volt cables on each phase with a No. 4/0 bare wire for the neutral.

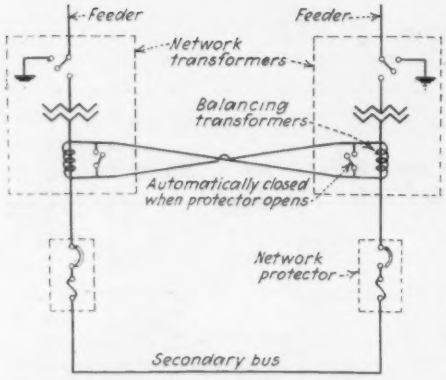


Two-unit vault in Joliet

The manhole-type street vaults are designed with separate transformer rooms and a combination bus and cable room. Sliding fire doors permit passage between the rooms. Removable reinforced concrete panels in the roof of the transformer rooms allow the lowering of the transformers with the protectors removed. The cables in the main conduit section passing through the bus room are racked on its outer wall. Taps from the primary cables are taken through ducts under the floor to the transformer terminals. In cases where only one transformer was installed the vaults are of the same design except that the second transformer room was omitted. This second room can be added to any or all of the single vaults if required later.



Plan of Oak Park vault



The balancing transformers are connected so that should the voltage of one transformer be more than the other reactance is automatically inserted in the circuit having the higher voltage. This arrangement prevents any appreciable energy transfer with differences in primary feeder voltages of as much as 10 per cent, which is considerably more than that experienced in normal operation.

To prevent load interchange between feeders

age for the radial load could be maintained without line-drop compensation. Therefore this compensation was omitted and the substation regulators were adjusted to compensate only for the variation in substation bus voltage.

This arrangement assured that the only interchange of energy between the two feeders would be that caused by the difference in line drop. Restraint devices were installed on the protector relays so that a small interchange of energy between the feeders was possible without the protectors opening on reverse current. It is expected that the feeders will operate satisfactorily with compensation not exceeding that corresponding to the point at which the first network transformer is connected.

The Oak Park installation is similar in most respects to the one in Joliet, although the problem here was to meet an increase in load. The new load had an estimated demand of about 500 kva. and it was necessary that an emergency service of equal capacity be supplied. The problem of paralleling the feeders was similar to that encountered at Joliet except that the feeders were much longer and considerable line-drop compensation was necessary to maintain proper terminal voltages. Therefore some method other than that used at Joliet was necessary in order to prevent load transfer from one feeder to another. This was accomplished by the use of balancing transformers installed on the secondary phase leads of each network transformer.

These installations at Joliet and Oak Park are the first cases of parallel operation of radial feeders on this system. Field tests and operation to date have shown that load transfers from one feeder to another have been satisfactorily controlled. Since no faults have been experienced on these systems no operating experience in regard to secondary burn-offs is at the present time available.

Highly Concentrated Searchlamp

Weighing but 11 lb., a signaling searchlight capable of transmitting 300 characters a minute to a distance of 30 miles, and said to be the most efficient for its weight ever developed, has been constructed by Westinghouse for the control room of the U.S.S. *Macon,* huge navy dirigible now under construction at Akron, Ohio. The weight includes the lamp, a 500-watt, 115-volt motion-picture projection type, and 20 ft. of cable. The beam candlepower of the unit is 500,000. A shutter operated by a "trigger" on the pistol grip by which the signaler holds the lamp makes the dots and dashes that spell out the messages to ground forces.

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READERS' FORUM

Rates and Commodity Prices

To the Editor of the ELECTRICAL WORLD:

In many of the recent issues of ELECTRICAL WORLD we read where city councils and state commissions in various sections of the country are requesting that public utilities reduce their rates "to bring them in line with existing prices of general commodities." In answer to these requests, some utilities have proposed reductions averaging possibly 10 per cent, while others have regretfully announced that, on account of decreased energy sales, any rate reductions would seriously jeopardize their financial positions.

Limiting utility earnings to a fixed percentage, as has been the custom, dictates lower rates as energy sales increase, while present-day conditions demand lower rates with decreased energy sales. Does this mean that the utilities shall be required to decrease rates when business is good as well as when business is poor? Or will it mean that earnings will eventually be based at, say, 10 per cent when commodity prices are high and, say, 5 per cent when they are low?

A varying rate of return for public utilities would bring their operations more in line with those of private business. In periods of low commodity prices, lower returns and lower prices would surely receive favorable reception from the public, but what is to be done, then, not to create ill feeling when rates may have to be increased in times of high commodity prices? Could economists justify such practices?

Should a fixed rate of return continue as standard, shall we then cut expenses and defer maintenance in times of low prices, as many have, in order to grant rate reductions and then increase expenses and catch up on maintenance in good times in order not to exceed a given return?

Commissions, executives and economists must have formed opinions on this timely subject. Could not ELECTRICAL WORLD present some of them?

L. M. GROW.

Wooster, Ohio.

[ELECTRICAL WORLD is always ready to publish pertinent constructive discussions of aspects of regulation from any competent person, be he speaking from the commission, utility, public or abstract economic standpoint.—EDITOR'S NOTE]

Men of the Industry

W. J. Hagenah Takes Office as N.E.L.A. Chairman

William J. Hagenah, vice-president and special counsel of the Byllesby Engineering & Management Corporation since 1928, has taken office as the first

chairman of the new National Economic Section of the National Electric Light Association, and as such becomes a vice-president of the association for the administrative year 1932-33. During the past twenty-two years Mr. Hagenah has been associated with many of the most important utility rate cases. He has contributed many papers and articles on public utility regulation, labor and economics. A graduate of the University of Wisconsin, he became statistician of the Wisconsin Bureau of Labor in 1905 and was Deputy Commissioner of Labor in 1906. When the Wisconsin Railroad Commission was established with broader power in 1907, he was appointed chief statistician of that body, and in this connection had a prominent part in the preparation of a widely adopted uniform classification of accounts for public utilities.

Later he established his own practice as consulting engineer and rate expert with headquarters in Chicago. Since 1928 he has been identified with the Byllesby interests and at the present time serves on the directorate of several subsidiary companies in the Standard Gas & Electric Company system.

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RICE MILLER of Hillsboro has been appointed a member of the Illinois Commerce Commission by Governor Emmerson to fill the vacancy caused by the resignation of Charles W. Hadley.

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W. P. STRANDBORG, for nearly eighteen years in charge of the advertising and publicity activities of the Pacific Northwest Public Service Company of Portland, Ore., has retired from the public utility field to open a free-lance newspaper and literary bureau. Mr. Strandborg was the founder and first president of the Public Utilities Advertising Association, and has for years been indentified with the advertising and public relations departments of the National Electric Light Association and the American Electric Railway Association.

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Paul M. Downing Heads N.E.L.A. Sales Section

Paul M. Downing, who has assumed the duties of chairman of the National Sales Section of the National Electric Light Association, has been prominently identified with the electrical industry on the Pacific Coast for a number of years, at present being first vice-president and general manager of the Pacific Gas &

Electric Company. A Missourian by birth, he went West at an early age and following graduation from Stanford University in 1895 engaged in engineering work for several utility and industrial companies.

Affiliating himself with the Pacific Gas & Electric Company in 1903, he became operating engineer, engineer of operation and maintenance, subsequently chief engineer of the electric department and in 1921 he was made a vice-president. Mr. Downing is a past-president of the Pacific Coast Electrical Association, a member of the American Institute of Electrical Engineers and of other engineering societies. As chairman of a national section of the National Electric Light Association, Mr. Downing also becomes a vice-president.

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LOUIS E. UNDERWOOD, managing engineer of the stationary motor engineering department of the General Electric Company at Lynn, Mass., has been appointed manager of the Pittsfield, Mass., works of the company to succeed E. A. Wagner, who has retired. Mr. Underwood joined the General Electric organization in 1897.

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F. A. WHITING has been appointed manager of the Housatonic division of the Connecticut Power Company, succeeding the late H. E. Lyles. Mr. Whiting has been associated with the company and its predecessors for the past 29 years. He will make his headquarters at Canaan.

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ROCK G. TABER, who has been manager of the Richmond office of Stone & Webster since 1929, has recently been appointed manager of the Fall River Gas Works Company at Fall River, Mass. Mr. Taber has been with the Stone & Webster organization for 22 years and his wide experience in public utility operation has been gathered in Dallas, El Paso and Houston, Tex.; Baton Rouge, La., and in Florida and Virginia. During the three years he had charge of the offices in Virginia he did considerable major construction work for the Virginia Electric & Power Company. A. W. DAVENPORT, as acting superintendent of construction, is succeeding Mr. Taber in Virginia.

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OBITUARY

W. D. B. Ainey

W. D. B. Ainey, formerly chairman of the Pennsylvania Public Service Commission, whose death was announced in ELECTRICAL WORLD, September 10, page 323, was a powerful factor in the development of the Pennsylvania Public Service Commission in its early years, and until his resignation last month as

chairman of the commission he was recognized as one of the outstanding utility commissioners of the country. He was appointed a member of the commission in 1915 and became chairman three months later, a position he held continuously until his resignation on the

eve of a senatorial investigation of his official conduct.

Mr. Ainey joined the commission about a year and a half after it began to function and it was under his direction that it became conspicuous as a regulatory agency. Pennsylvania was one of the first states to broaden the scope of its utility regulation and is credited with much of the pioneer work which guided other states in the way of regulation practice. This work of national importance was accomplished under the leadership of Mr. Ainey.

In addition to performing his duties for the commission, he occupied himself with economic, political and civic activities. He served as chairman of the Pennsylvania Fuel Commission in 1922 and in 1924 was elected president of the National Association of Railroad and Utilities Commissioners. Mr. Ainey was born in New Milford, Pa., in 1864, and was admitted to the bar in 1887.

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MAGNUS W. ALEXANDER, for the last sixteen years president of the National Industrial Conference Board, died September 10, of a heart attack, at his home in New York. He was 62 years of age. Mr. Alexander helped to organize the board in 1916 and in the capacity of president he was frequently the spokesman for several of the country's greatest industries. Born in New York in 1870, he studied engineering in Austrian universities and began his career with a large Austrian steel company. Returning to this country in 1893, he became designer and engineer for the Weston Electrical Instrument Company and the next year joined the Westinghouse Electric & Manufacturing Company, with which he remained until 1899. After spending several months with the Siemens & Halske Electric Company of America, he joined the General Electric Company in 1900. For eighteen years Mr. Alexander was the engineer in charge of design for that company, and in 1918 was made engineer on economic issues in a consulting capacity. He was a member of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers and of other engineering associations.

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J. FRANK ZOLLER, tax attorney of the General Electric Company, died September 3, as a result of injuries inflicted by a bull of his prize herd of cattle, at his Walhalla Farm outside of Schenectady, N. Y. Mr. Zoller was one of the country's foremost tax experts. Twenty-five years ago he became assistant secretary of the General Electric Company and in 1915 was named tax attorney. He also continued as assistant secretary. Mr. Zoller represented the New York State Tax Commission on tax revision on the budget committee.

New Equipment Available

Fixed-Gap Ammeter Speeds Circuit Tests

A fixed-gap ammeter comprised of a shielded dead-beat meter mounted on a magnet frame with a fixed gap where the current-carrying conductor is inserted is announced by the Bowie Switch Company, San Francisco, Cal. For high voltages the instrument is mounted on an insulating stick, giving instant readings when placed over the conductor. The standard instrument has a double scale 100 and 400 amp. full deflection.

Among its applications are testing motor and power loads for customers, checking distribution transformer loads and balance, checking load on high-voltage circuits and checking load on high-voltage tap lines, also checking load on high-voltage power transformers and checking balance of high-voltage, three-phase circuits.

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Device for Measuring Density of Smoke in Flue Gases

A smoke density meter that is easy to install and operate and which requires a minimum of attention is announced by the Brown Instrument Company, Philadelphia, Pa. It is a device for measuring the density of smoke in flue gases by electro-optical means, as indicated in the accompanying figure. In this form of smoke meter a portion of the flue gas is made to pass between a source of light and a light-sensitive device. When the smoke in the flue gas varies in density the amount of light falling upon the light-sensitive device also varies, and the resulting current variation from the photo-cell due to the amount of light falling upon it permits the meter to be calibrated in terms of smoke density.

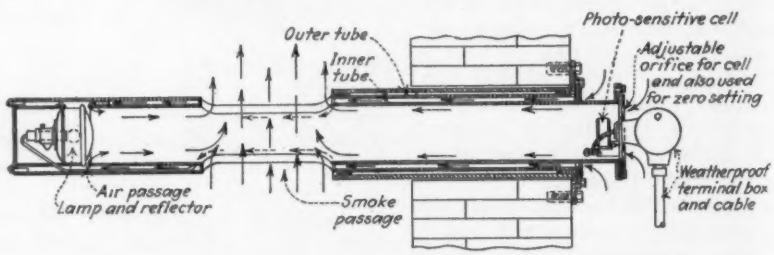
Photo-sensitive cell
Outer tube
Inner tube
Adjustable orifice for cell and also used for zero setting
Weatherproof terminal box and cable
Air passage Lamp and reflector
Smoke passage

The chart of the recording instrument is calibrated to read in per cent smoke density. The indicating scale may read in per cent or in terms of Ringelmann smoke scales. The principal units of the smoke-density equipment are the sampling tube, containing a source of light and a photo-cell; the control panel and an indicating or recording instrument.

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RAPID REVERSING SQUIRREL CAGE MOTORS, capable of as many as 60 reversals per minute continuously without overheating have been perfected by the Louis Allis Company, Milwaukee, Wis. This rate of reversals has been made practical through light-weight rotor construction, efficient ventilation, high torque characteristics and shock-resisting cast-iron frames.

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ARTIFICIAL ILLUMINATION requiring low wattage, a long period of burning and a small amount of light is now possible with the new 3-watt "Mazda" lamp announced by the General Electric Company. It has a candelabra base, an S-6 bulb and is designed for 115-volt service. Some of the more common uses for this small light source are in exit signs, house numbers, illuminated ornaments, small interior electric signs, etc.

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AN ATTACHMENT PLUG differing from conventional design, in that the part to which the cord is attached swivels, thereby eliminating twisting, kinking and short circuits, is announced by the Swiv-All Products Corporation, Bridgeport, Conn. The current-carrying capacity is in excess of 250 volts, 660 watts. The plug has been tested for over 5,000,000 revolutions with two lighted 60-watts lamps and with no appreciable wear of the contacting parts.

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A MINIATURE SIZE RECORDER to check the performance of refrigerating, air-conditioning or heating equipment adequately is announced by the C. J. Tagliabue Manufacturing Company, Brooklyn, N. Y. The recorder is furnished in two forms, the single-pen recording thermometer for charting temperature only and the temperature and time-operation recorder which writes a continuous record of temperature as well as the running and idling time periods of the motors.